MAPPING MADRAS: GEOGRAPHIC INFORMATION SYSTEMS APPLICATIONS FOR METROPOLITAN MANAGEMENT IN DEVELOPING COUNTRIES

by

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to

Mom,

who always understands.....

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ABSTRACT

There is a major push for the use of GIS in the developing world. This is, in part because some planners in developing countries see it as a suitable tool to deal with problems of rapid urbanization more effectively. International donor agencies dealing with similar issues also see GIS as part of a technical solutions package. Placed in this context, my thesis questions: What are the potential benefits and constraints to GIS being adopted in metropolitan planning agencies in developing countries?

The Madras Metropolitan Development Authority, MMDA, a planning agency in southern India set up by the World Bank acts as an appropriate case study subject because its organizational structure is representative of many planning agencies in the Third World. Huxhold's (1990) model of GIS applications and Croswell's (1989) matrix of constraints that impede GIS adoption and successful implementation in the U.S. provided a theoretical framework for the research.

Using this matrix as a reference point and Huxhold's 3-tier framework, the specific thesis research questions are:
1] How might MMDA use GIS in their policy planning and for regional development (e.g., long-range land use policy)? 2] How might MMDA use GIS in improving management and coordination of their frequent planning functions (e.g., inter-agency data requests)? 3] How might MMDA use GIS to improve the efficiency and reduce the costs of performing routine tasks (e.g., permit tracking)? Together, these three questions form the basis for a typical user needs assessment as now conducted widely in the U.S. Additional research questions are: 4] What technical and organizational constraints may limit the use of GIS in (1-3) above? 5] What potential organizational changes might result from GIS implementation?

The research identified nine potential benefits that facilitate GIS adoption and five constraints that were likely to impede its adoption in planning agencies. It also identified seven factors which were key to successful GIS implementation in Madras which included achieving clarity in problem definition, conducting of an user needs assessment, establishing inter-agency coordination, training of personnel, organizing the collection and management of data, designing an incremental system for development and taking advantage of the important role of advocates within the organization. The research has recommended a viable GIS implementation path for MMDA and identified three directions for future research.

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GLOSSARY OF TERMS AND ABBREVIATIONS

HUDCO	Housing and Urban Development Corporation
MCC	Madras City Corporation
MMA	Madras Metropolitan Area
MMDA	Madras Metropolitan Development Authority
MMWSSB	Madras Metropolitan Water Supply and Sewerage Board
MUDP I &II	Madras Urban Development Project, Phase I and II
NIC	National Informatics Centre
TNEB	Tamil Nadu Electricity Board
TNHB	Tamil Nadu Housing Board
TNSCB	Tamil Nadu Slum Clearance Board
TNUDP	Tamil Nadu Urban Development Program
Panchayat	A hierarchical government organization, representative of the village
Taluk	A sub-administrative unit

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Chapter 1

PROLOGUE

1.1 Objectives and Significance of Research

1.1.1 Objective

The objective of this thesis research is to ascertain the potential benefits and constraints of the transfer of a new technology such as Geographic Information Systems (GIS) to metropolitan planning agencies in developing countries. While it seems inevitable that technology transfer will occur in some form, it may not be efficiently utilized and thus may be a wasted effort. However, if the constraints to the transfer are understood and solved, then the benefits that might result may well be worth the resources spent on the effort.

1.1.2 Significance of Research

I believe that the research is significant because successful technology transfer does not depend merely on the transfer of system hardware and software but on other components. These include the suitability of the techniques, organizational capability, trained personnel and above all, acceptability of the technology by the decision making group. To study technology transfer for planning without addressing these issues concurrently will be futile because the analysis will not present the full picture.

I am hoping that while I examine the issue of Information Technology/Systems transfer I will find out more about the institutional and organizational issues that affect this process. This will help formulate a better means of creating such a transfer for similar situations in other developing countries.

1.2 The Question Evolves

Geographical Information Systems (GIS) provide a means for linking conventional databases with geographical references to spatial mapping tools. Currently, GIS analysis involves overlaying a series of coverages, (e.g., maps) of the same geographic region, each overlay displaying a typical characteristic of the region. Suitability analysis, using these overlay functions, is one of the principal planning applications of GIS. Properly designed GIS provide the mechanism by which different planning and management agencies can keep track of the improvements they make from day to day and to be aware of the changes that other agencies are effecting in the same areas, thus ensuring that the records are continually updated and stored without the cumbersome and time consuming process of the continual manual mapping of such facilities.

The technical literature on GIS helped me understand the current state-of-the-art, and specifically the extent to which GIS has been used in planning and coordination agencies. The literature on GIS applications in the US covers a lot of ground on organizational issues and discusses the gap between potential capabilities of GIS in assisting planning functions and constraints that impede GIS adoption and successful implementation.

Drawing upon the literature, I decided to use a case study approach and look at a planning agency in India which would be a potential GIS user. The agency that I have chosen to study is the Madras Metropolitan Development Authority (MMDA) which was set up in 1972. The World Bank is a major contributor to MMDA's planning efforts and perceives the agency as one capable of innovation, having a high level of technical expertise, and relatively free from the political and bureaucratic hassles that plague most of the development authorities in India.

Thus, MMDA is unique in some respects, but its organizational structure and the planning problems it has to deal with are typical to many developing countries.

1.3 Background and MMDA's Planning Problems

1.3.1 Background

The Madras Metropolitan Development Authority (MMDA) is the chief planning agency controlling all development within the Madras Metropolitan Area, (MMA). It was set up in the early seventies by the Tamil Nadu government. World Bank funding has helped to implement its projects and programs. Since its inception it has strived to provide and maintain an acceptable living environment for the citizens of the region through a variety of spatial structuring and zoning methods. It has also been responsible for the creation of the First Master Plan for the region and is working on the preparation of the second one.

Through the Madras Urban Development Programs, MUDP I and II, the MMDA has been entrusted with the role of supervising the execution of multi-sectoral programs/projects sponsored by the World Bank. It is expected that this trend will continue with the extension of the Madras Urban Development Program to cover the entire State under the Tamil Nadu Urban Development Program (TNUDP). The MMDA also determines the appropriate land use and zoning within the metropolitan area. As part of this process, the MMDA regulates public and private development within the metropolitan area. It issues planning permits for construction and processes applications which request change of land use classification.

1.3.2 Statement of the Planning Problem:

The Madras Metropolitan Development Authority is the architect of the second Master Plan for the Madras Metropolitan Area. The new plan seeks to place greater emphasis on "economic planning" and its integration to land use planning. The "horizon year" for this plan is 2011. There is an on-going research effort which is seeking to correct a critical deficiency of earlier planning exercises which gave undue importance to land use planning alone.

The first step towards this effort has been ascertaining the scale and magnitude of the emerging demographic growth and its spatial dimensions. The population of the MMA is currently 4.6 million of which 3.2 million live within the core city area. The density here is approximately 190 persons per hectare. The population projections for the coming decade indicate that the present trend of increasing population growth will continue. This will result in the core area of the MMA getting more and more overcrowded because of the city's ability to provide a better level of service than the peripheral towns and urban nodes which are not yet well connected to the Central Business District.

One of the main objectives of the proposed Master Plan for the MMA is to reduce the pressure and population growth within the city area and to promote a more desirable spatial pattern. A second objective is obtaining land for the provision of shelter for the lower income groups at affordable prices and at appropriate locations. The MMDA is also expected to coordinate the working of more than fifty governmental, parastatal and municipal organizations operating with its jurisdiction.

Given the experience in the U.S., the initial assessment of the possibility of using GIS to assist and enhance the technical capabilities of the MMDA seems to indicate that it is a practical and cost-effective solution. Information about land use and the density of that use usually depend on population characteristics. These data are usually obtained from census records. Information about land such as the nature of the land use, ground cover, wetlands, etc. are obtained from aerial photographs. Working with reliable and accurate data is the goal of any planning process, which in this context is better understood in a spatial form.

1.4 Statement of Research Questions

My overall research question is **" What are the potential benefits and constraints to Geographic Information Systems (GIS) being adopted by metropolitan planning agencies in developing countries."**

Huxhold's (1990) model of GIS applications provides a theoretical framework for answering specific questions about the potential benefits in a regional planing context for developing countries. The model provides a 3 - tier framework for GIS use : 1] Policy formulation; 2] Management; and 3] Routine task automation. Croswell (1989) provides a matrix of constraints that impede GIS adoption and successful implementation in the U.S.

Using this matrix as a reference point and Huxhold's 3-tier framework, the specific thesis research questions are:

1. How might MMDA use GIS in their policy planning and for regional development (e.g., long-range land use policy)?
2. How might MMDA use GIS in improving management and coordination of their frequent planning functions (e.g., inter-agency data requests)?
3. How might MMDA use GIS to improve the efficiency and reduce the costs of performing routine tasks (e.g., permit tracking)?

Together, these three questions form the basis for a typical user needs assessment as now conducted widely in the U.S. Additional research questions are:

4. What technical and organizational constraints may limit the use of GIS in (1-3) above?
5. What potential organizational changes might result from GIS implementation?

1.5 Outline of Chapters

The thesis is divided into eight chapters. This chapter is a brief description of the problem from a personal viewpoint, and sets out the research questions.

Chapter Two, *Research Design*, accomplishes two things. First, it reviews the literature on GIS applications to Planning and discusses the Huxhold model and the Croswell matrix of constraints in greater detail. Second, it lays out the steps of the research design.

Chapter Three, *Metropolitan Management in Madras,* provides an overview of the city context highlighting the planning problems faced by the city and the metropolitan region. The chapter also profiles major planning agencies in the area making specific reference to their computing capabilities and defines the formal and informal links existing between different agencies.

Chapter Four, *MMDA's Work in Actuality,* is a descriptive chapter which contrasts the stated goals of the organization, MMDA with the actual work processes and documents the differences.

Chapter Five, *Critique of MMDA's Computerization Efforts,* describes the computerization process undertaken to date by MMDA and discusses its achievements and shortcomings.

Chapter Six, *Interview Results and Synthesis,* culls out the important issues raised by different people interviewed which will lead to an analysis of the potential benefits and constraints to GIS adoption.

Chapter Seven, *A Sustainable GIS for MMDA,* details the requirements to sustain a GIS implementation effort and spells out the constraints. This chapter pulls together the views and experience from the literature and the results of the interviews to set the framework for a workable solution.

Chapter Eight, *Looking Towards the Future* concludes the thesis by discussing the usefulness of the GIS to the people of Madras and, the agency It also raises some interesting questions not addressed in this thesis that provide a direction for future research.

GIS applications have increasingly pervaded the planning profession in the U S and reviews of applications of GIS suggest that in addition to the issues of technical feasibility, the critical factors that determine the successful operation of the system are the management of information and the planning process itself.

That is, " the overall success of incorporating information technology into the urban and regional planning process will ultimately depend on political and organizational factors" (Elam, 1990).

What is the future of GIS in developing countries? Will it be a short lived fad? Will it dramatically change the planning institutions' function in these countries? This thesis is a beginning towards addressing those questions.

Chapter 2

RESEARCH DESIGN

In this chapter, I will present two sections, the first one will describe my research design strategy and the second section will review some of the literature that was useful to define a frame of reference to complete the case study and analysis.

2.1 Research Design

My research design consisted of the following eight stages which I will discuss one by one.

2.1.1 Defining the Research questions

The research questions resulted from the literature, or lack thereof, about GIS applications to planning in developing countries. It crystallized because of the series of interviews that I had with urban planning professionals at the International Bank for reconstructions and development who appeared to be encouraging the transfer of GIS technology to developing countries. They had realized that there was little or no work done about the organizational constraints that affect GIS applications in developing countries.

"Cities should have some means of assembling, analyzing and disseminating relevant information area by area as well as sector by sector in order to guide decision making. Urban management should use such systems of information to coordinate intersectoral and inter-agency activities on a planned spatial basis" writes Sivaramakrishnan (1986). GIS appear to be a suitable tool to help achieve the coordination envisioned, and metropolitan planning agencies appear to be the most likely place to introduce such a new system. In addition, I was aware that metropolitan planning agencies would be the ones to become aware of these

innovative technologies through vendors of new software and by the consultants from the Western world. Thus I defined my broad research question as "What are the potential benefits and constraints to GIS being adopted by metropolitan planning agencies in developing countries?"

2.1.2 Purpose of the research

The purpose of this research is to inform and add to the body of knowledge created about the issue of GIS implementation in developing countries. The U.S experience has shown that technology transfer does not depend on technical issues alone, by and large it is the political and organizational factors that affect its implementation (Elam, 1990).

2.1.2 Case study technique and selection of appropriate case

The question appeared to benefit from the study of an actual case where technology transfer had occurred so that an assessment could be made. The selection of the country was made because of my familiarity with its planning context. Within the country, there were many metropolitan planning agencies to look at and each one had its own successes and failures. I chose to look at the city of Madras and the case of the Madras Metropolitan Development Authority for the following reasons:

1] The agency has had a track record of being successful in project implementation. The literature has emphasized that the Urban Development Programs carried out with funding from the World Bank had reached the intended beneficiaries and MMDA's strategies had been credited (Pugh, 1988).

2] Based on their performance, the MMDA had received some additional money as part of a larger state wide program which has adopted and refined the goals of the metropolitan slum improvement and sites and services programs (MMDA Technical Reports, 1990).

3] In 1989, the MMDA had introduced computers into the organization to assist in certain basic planning functions and was looking towards more innovative techniques that would help them in their day to day work.

4] The World Bank was encouraging using Madras as a test ground to understand the implications arising due to the adoption of this new technology because of its otherwise good track record concerning project monitoring and implementation.

The MMDA is a unique example of a development authority in India in that it is relatively free from political interference in its decision making, unlike the other major metropolitan authorities in Bombay and Calcutta. It also seemed appropriate to study this authority since it was the first agency to introduce computers in India, it might well be the first Agency to introduce GIS, and it is certainly a potential GIS user.

Thus, finding no example of an implemented GIS in a metropolitan authority in the country I wanted to look at, I chose to look at a potential GIS user instead. In addition, I chose Madras because of my familiarity with the region and the city.

2.1.4 Framework for Analysis

Huxhold (1990) provides framework for analysis which describes GIS implementation efforts in the U.S. Huxhold's (1990) model of GIS applications provides a theoretical framework for answering specific questions about the potential benefits in a regional planing context for developing countries. The model provides a 3 - tier framework for GIS use : 1] Policy formulation; 2] Management; and 3] Routine task automation. Croswell (1989) provides a matrix of constraints that impede GIS adoption and successful implementation in the U.S.
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5. What potential organizational changes might result from GIS implementation?

2.1.5 Interview design

In order to address these five questions, I needed a set of specific interview questions that I could use during my field trip to Madras. While in Madras, I interviewed officials within the MMDA. These included the administrative heads of the authority, specifically, the Chairperson and the Member-Secretary, and technical personnel like the Chief Urban Planner and the Senior Planner, among others. I also interviewed officials from other agencies who coordinate routinely with the MMDA (e.g., the Tamil Nadu Housing Board, the Tamil Nadu Slum Clearance Board and the Housing and Urban Development Corporation).

Organizational Issues

Some of the questions which the interviews answered are:

1] Who makes the technical decisions within the MMDA and what analytic methods or information technologies do they currently use to help them in their decision making process? (e.g.., microcomputers, spread sheets, database management tools).

2] What tasks currently being undertaken by the planning agency involve the use of spatial information? In what form is this information available and to what level of detail? How is the output generated?

3] What kind of data is required to carry out the routine planning functions of MMDA? To what extent is MMDA dependent on other agencies such as the Tamil Nadu Housing Board for this information? Is there a system of data sharing? Is the system formal (i.e., through an established channel of communication) or informal (i.e., through the personal rapport between the officials concerned)?

4] What is the the data maintenance system of MMDA? If there is a system, how is the data stored and updated?

Technical Issues

Huxhold (1990) suggests that GIS is a useful tool for three main functions: 1] for policy formulation (e.g., generating growth scenarios for the future to determine patterns of employment); 2] for better management of tasks involving the participation of different divisions within the agency, where each division is in charge of one aspect of the routine management (e.g., coordinating the activities of the planning permit sanctions and the enforcement of the development control rules); and 3] to automate routine tasks within the agency, (e.g., keeping track of building activity within each zone in the metropolitan area).

This framework suggests three focus applications, one at each level of the 3-tier framework: Given my limited interview time for this research, I chose one focus application for each of the 3-tiers in the framework. This provided an efficient research strategy. The focus applications were:

1] Land Use forecasting at the regional and subregional level (e.g., by determining the kind of industrial growth and expansion that would take place in the next decade and attempting to predict, using other models, the spatial distribution of these activities);

2] Facilitating the linkages between different divisions within MMDA (e.g., the planning permit sanctioning division and the enforcement division) and between agencies operating within the metropolitan area;

3] Accelerating the development review process which involves keeping track of the planning permit sanction process.

Given these focus applications, I proceeded to interview the concerned actors who are dealing with these issues on a day-to-day basis. An organizational chart and initial interviews aided my interview selection process. I also interviewed the administrative and the technical heads of the agency. I did not introduce GIS at the outset to these individuals but started the discussion with an assessment of their

planning tasks and the mapping needs of each section. This followed the now accepted procedures of a user need assessment used in the U.S. The interviews clarified:

1] Who are the actors assigned to carrying out specific tasks and their technical capabilities?

2] What information (particularly mapped and structured data) did the agency need in order to accomplish their planning tasks efficiently?

3] What current problems did they face in carrying out these tasks, and the time that is required to carry out these tasks?

4] What are the different flows of information within the organization and what is the manner in which this information is currently being presented?

5] What are the decision-making processes in the organization?

I looked at the decision -making process within the organization and how much of that decision-making the interviewees felt was data driven. This helped to point out the kind of data that might be incorporated into a GIS to help in the decision making process.

2.1.6 Identification of potential interviewees

I made this decision in the field and interviewed all administrative and decision making heads of departments within the MMDA and in the other agencies. I also talked to a cross section of people at different levels in the organizational hierarchy.

2.1.7 Interviews

I based my interview design on the format provided by Steve French, et.al., who have conducted extensive user needs assessments in the United States (Design Institute Report, 1989). This framework was modified to suit the context of the country and the technical understanding present in the agency.

2.1 Literature Review

I looked at three different bodies of literature to build up a knowledge base to help address my research questions.

GIS Applications to Planning

I looked at the technical literature on GIS to understand the current state-of-the-art, specifically trying to ascertain the extent to which GIS has been used in regional planning and coordination agencies. The tasks for which the systems have been used gave an indication of the relative successes and failures of using a GIS to accomplish certain specified tasks. I used the proceedings of the Urban and Regional Information Systems (URISA) conferences and other journals to cull out information related to planning applications of GIS in developing countries.

The literature on GIS applications in the US covers a lot of ground on organizational issues and discusses the gap between potential capabilities of GIS in assisting planning functions and the constraints that impede GIS adoption and successful implementation Huxhold (1990), Croswell (1989).

Huxhold (1990), describes city business as working in a pyramidal fashion, with policy at the apex of the pyramid which relies on a set of deliverable operations which is at the base. A managerial component in the middle works to translate the policy set to the specific tasks required to be accomplished. Information in the urban business pyramid flows up and decisions and results flow downwards. According to Huxhold, if any of these three components is not functioning properly it is often the result of the lack of proper flow of required information. He also points out that urban information is predominantly location specific and it is this geographic nature of the data that will help the success of a GIS. His discussion is centered around agencies who have been using computerization without spatial referencing for their operations and decision making and hence is relevant only conceptually to my developing country case context.

In my study, I have used to Huxhold model to understand if in fact information flow works in the manner that he describes in my case study. The model was useful as a reference point to start my analysis.

Croswell, (1989) discovered that although GIS's have been in place for over ten years in the United States, there is a large history of problems in implementation. Through a review of literature on operational GIS, he has defined a set of constraints that commonly impede GIS implementation. Of this review, the most significant problems were caused by first, lack of organizational coordination and conflicts; second, problems in data and software standards and data integration; and third because of lack of planning and management support. These three major problems were followed closely by problems of awareness of technology and lack of training.

If such problems are common in the developed countries, then the issue in developing countries must be more complicated. However, the writing about GIS applications in the Third World is detailed. The working papers of Klosterman (1990) and Batty (1990), however, have provided the starting point for research into this area. The papers also discuss the appropriateness of GIS use in developing countries by addressing the organizational and institutional issues that accompany technology transfer. They fail to discuss specific issues but rather attempt to compile a laundry list of items that affect GIS implementation. I feel that the case study that I am doing will contribute to a collection of specific cases which could be compared at a later date to draw some general conclusions.

Institutional Analysis

The writings of Friedmann (1987) have been useful in clarifying some approaches to planning in the developing country context. Agarwala's (1983) review of the planning experiences of developing countries also offers insight into approaches that have worked in different country contexts.

I am looking at the transfer of technology/systems to a particular institution, in this case, the Madras Metropolitan Development Authority. For this purpose,

Sanyal/Tewari's (1990) case study of the Calcutta Metropolitan Development Authority was a useful reference to understand the historical and institutional context of the working of a planning agency. The study traces the evolution of the Authority and examines the reasons for its decline from a position of preeminence in metropolitan management to relative obscurity. Though this case study was useful in clarifying the political constraints that Development Authorities operate under in India, it does not address the issue of information flow within the organization and does not discuss the impacts of 'structured data' on the decision making process.

My best reference source was Sivaramakrishnan's (1986) book on metropolitan management which profiles eight metropolitan cities and reviews their performance. Madras and Calcutta found a place in this book and made it a useful source of information about the institutional framework operating in India. Sivaramakrishnan says that there is a conflict between the traditional public administration in place since Independence and the development administration which is recently being attempted.

Institutional Context

The World Bank Reports (1977, 1989) provided documentation about the creation of the MMDA and has reports on each project undertaken by it. To place the research in context, I examined the creation of the MMDA, which is currently a fairly large organization with about seven hundred staff and a centralized decision making system of operation. I also looked at the projects that MMDA has undertaken, the kind of operational difficulties it faces and the process of decision making within the institution. Field work through interviews as well as personal knowledge of the region filled in the rest of the required information.

Having established a frame of reference and a plan of action, in the next chapter I will discuss the context of the city and the planning problems it faces. I will then profile the planning agencies operating in the Madras metropolitan area.

Chapter 3

METROPOLITAN MANAGEMENT IN MADRAS

Institutions are significantly affected by the physical setting and the political environment within which they operate. Since I intend to understand the actual working of the Madras Metropolitan Development Authority (MMDA), I will first describe Madras, its physical expansion and the various metropolitan planning and management problems that have led to the creation of the MMDA and continue to have an impact on its day to day working. The process of mapping the links of MMDA to other agencies operating within the region enable me to understand the nature of inter-agency coordination and explore the relevance of a multi-user GIS. My references for this chapter come from two major sources, Muthiah's (1987) book called Madras Discovered and Sivaramakrishnan's (1986) book, Metropolitan Management.

3.1 Background - Region and City Profile

3.1.1 Origins

Madras, now the fourth largest metropolis in India, was founded in 1639 by Andrew Cogan and Francis Day who were officers of the English East India Company. In 1640, the foundations of present day Madras were laid through the beginning of the construction of a fortified enclosure which was completed on April 23, 1640, St. George's Day. Thus, the fort came to be called and continues to be known as Fort St. George. The fort was the beginning of city planning and two distinct urban agglomerations began to evolve, the 'White Town' which essentially developed inside the fortified enclosure and the 'Black Town' that developed outside. Nurtured by the English, the tiny settlement grew into a moderately large town.

By the end of the seventeenth century, Madras was the chief British settlement in India. Madras grew slowly but had a tendency to sprawl, the boundaries being extended periodically. By the beginning of the nineteenth century Madras city had taken its present shape (Figure 1). The rapid growth of the city came during the war years, (1939 -1945). Since Indian Independence in 1947, Madras has not stopped growing.

3.1.2 Development of the City: 1947 - 1981

Madras, since Independence is the capital of the state of Tamil Nadu and the largest city and the commercial capital of southern India. The city grew at the rate of thirty-two percent during the sixties and seventies encouraged by the national policies that favored rapid industrialization. The Madras Port and Container Terminal developed during this period as did many related ancillary industries. The addition of a fertilizer plant and and an oil refinery in the area boosted the economy and added jobs. A large automobile industry developed. However, all the factors mentioned above had combined to encourage migration into the city. Forty-three percent of the population growth between 1961 and 1971 was attributed to migration. The city has suffered under the onslaught of migratory pressures but seems to be unable to turn the tide.

3.1.3 Metropolitan Problems

Typical of major metropolitan cities in developing countries, the development of Madras is affected by a poor water supply and sewerage system and inadequate power supply. These factors affect the growth and development of the city.

One of the important reasons preventing the city's ability to cope with the increased population is the acute shortage of potable water supply to the city. The estimated reliable yield of water is about 290 million liters a day, and this is less than half of the supply needed. In addition, the distribution network is severely strained. The foundations of the city's distribution network was laid in 1911, the population it was designed for was exceeded thirty years ago. Reservoirs of rain water are the main

water supply source for the city. However, these reservoirs have become silted and now have a reduced capacity. Thus, no advantage can be taken during the years when the rainfall is plentiful. Four rivers flow through the metropolitan region, (Figure 1). Every year, during the monsoon season, the excess water from the reservoirs is discharged into these rivers and this causes flooding and consequential damage to low lying residential areas.

A related but important problem is the inadequacy of sewer facilities. The existing facilities serve only 31 percent of the metropolitan population. Raw untreated sewage is allowed to flow into the city's natural water courses at many points. A combined system of sewerage is adopted because the storm water run off is negligible except for the months of the monsoon (November through March). This results in sewers getting clogged due to the solid waste that finds its way into the sewers and impedes the flow. During the rainy season, the sewage overflows and contaminates private and public drinking water sources.

Inadequate shelter, especially for the economically weaker sections of society, is another major problem. The pattern of housing demand is typical of cities in many developing countries. With the supply of land limited and constant, there is a concentration of high rise building activity within the city and low rise urban sprawl in the suburbs. The hardest hit are the poor, especially the new migrants to the city. The slum population of Madras is now 2.26 lakhs (1 lakh = 100,000). This population usually provides itself with the barest minimum of shelter, usually along the river banks and along the railway tracks. These squatter settlements have the barest minimum of or no infrastructure. A very small proportion of these people appear to have benefitted from the shelter schemes that have been instituted so far. The rate of housing supply cannot keep pace with the demand and the number of homeless people, who dwell on pavements has increased (MMDA Technical Reports, 1990).

Other essential services failing to respond adequately to the growing metropolitan needs include power supply, public health and education. A common problem is the lack of financial resources needed to operate and maintain these

services. The informal sector has grown in the past decade, although little growth has been observed in the formal sector of employment.

3.2 The Creation of the Madras Metropolitan Development Authority

3.2.1 History

The Madras Metropolitan Development Authority, MMDA was set up as a statutory body under the auspices of the Town and Country Planning Act of 1972 and amended by Tamil Nadu Act 22 of 1974. The creation of MMDA was an effort to address the problems of Madras at a broader level. In brief, the Authority was set up to coordinate, monitor and regulate all development in the Madras Metropolitan Area.

3.2.2 The Madras Metropolitan Area (MMA)

This is an area of 1174 square kilometers, encompassing the Madras City area, four municipalities and five townships (Map 2). The population of the MMA was 1,268,541 in 1981 and it continues to grow.

3.2.3 Objectives

The three main objectives of the MMDA are:
1] planning for the physical infrastructural and economic development of the Madras metropolitan area and enforcing the Master Plan for the MMA and the development Control Rules which were framed under the Master Plan;
2] formulating, monitoring and coordinating projects for metropolitan development aided by the State or national Government or external institutions;
3] promoting civic development projects for planned and orderly growth.

3.2.4 Metropolitan Administration

It is clear from the above description that major metropolitan decisions are taken by the MMDA. However, the MMDA cannot be defined as a representative

organization. Only one of its seventeen members is a representative of local government - the Commissioner of the Madras City Corporation. He is again a state appointed official. Other members of MMDA's board include the heads of the various planning agencies profiled in Section 3.4, below, in addition to representatives from the Department of Public Works, Local Administration, Finance, Transport, and Industries. When MMDA was first organized, the Chairman was the Chief Minister of the State of Tamil Nadu. Due to time constraints, this task was delegated to the Minister of Housing and Urban Development. It has an advisory council which is made up of representatives of various professions, both in the private and public sectors.

3.3 Organization of Functional Units

The authority is comprised of a team of professional and administrative personnel. There are three clearly defined functional units; 1] the Master Plan Unit, 2] the Development Planning Unit and 3] the Area Development Unit. The organization is heirarchically arranged, with distinct bureaucratic and technical segregations. MMDA employs about seven hundred and fifty people and is considered to be a medium sized planning agency.

3.3.1 The Master Plan Unit

One of the most important tasks of the MMDA at its inception was the creation of a Master Plan for the development of the MMA. The first Master Plan was completed and has been in force since 1975. The new Master plan for the Madras metropolitan area seeks to place greater emphasis on "economic planning" and its integration to land use planning. The "horizon year" for this plan is 2011. There is an on-going research effort seeking to correct what the agency felt was a critical deficiency of earlier planning exercises which gave undue importance to land use planning alone.

The first step towards this effort has been to ascertain the scale and the magnitude of the emerging demographic growth and its spatial dimensions. The population of the MMA is currently 4.6 million, of which 3.2 million live within the

population projections for the coming years indicate that the present trends will continue. This will result in the core area of the MMA getting more and more overcrowded because of the city's ability to provide a better level of service than the peripheral towns and urban nodes which are not yet well connected to the Central Business District.

Thus, one of the main objectives of the proposed Master Plan for the MMA is to reduce the pressure and population growth within the city area and to promote a more desirable spatial pattern. A second main objective is to obtain land for the provision of shelter for the lower income groups at affordable prices, at appropriate locations. The various instruments that can be used by the MMDA to achieve these objectives are the Zoning and Development Control Rules.

The present research effort is being coordinated by the Master Plan Unit in conjunction with a consultancy. Their findings are expected in June 1991. Currently, the Master Plan Unit is working on the inventory of the land use and other data gathering efforts and is determined to make the Second Master Plan document a more pragmatic one than the first one in terms of classifying areas for different land uses. The Master Plan Unit has three important divisions; the Area Plans Division, the Enforcement Division and the Consultancy Division.

The Area Plans Division

The Area Plans Division of this unit is responsible for the planning permit sanctioning and decision making regarding land use reclassification This division also issues planning permission for development of

1] for individual buildings
2] for layouts and sub-divisions
3] for special buildings (i.e., where the nature of the development is greater than three floors, 300 sq. m or three dwelling units).

The division also reviews the land use classification periodically and modifies the classification to suit the current trends occurring in the area. Many times this is

undertaken because interested applicants request a change of classification and ask for a decision from the MMDA. In certain instances, applicants whose planning permission has been denied are entitled to appeal that decision to the State Government. When they do so, their petitions are referred to MMDA for an opinion to help the government reach a final decision. Certain local bodies, though falling within the jurisdiction of MMDA, have been delegated power to issue planning permission for smaller residential developments. These processes are regularly reviewed by this division.

The Enforcement Division

Part of MMDA's objectives are to monitor the development within the MMA and enforce the Development Control Rules framed by it. This includes the detection, prevention, and removal of unauthorized development as provided under the law. Staff of this division routinely inspect all development within the metropolitan area and check consistency of the development with the approved permissions. Violators are issued warning notices and non compliance with the rules results in fines being levied or in certain instances demolition notices being issued and then the actual demolition undertaken.

Counselling and Consultancy Divisions

The Authority offers counselling to the public who approach it in person though this division. The citizens are educated about the procedures that are to be followed in applying for planning permission and the requirements they have have to follow to carry out any development. Developers are advised about the compatibility of their developments with the Proposed Master Plan's zoning guidelines and the planning parameters that must be complied with to begin construction. The division also discusses various alternative options open to the developers.

3.3.2 The Development Planning Unit

This division, through the external funding received from the International Development Agency, IDA, assists the Government of Tamil Nadu to improve the provision of urban services and provide employment opportunities and to make these interventions responsive to the needs of the urban poor. To date, the three major projects were undertaken through this unit.

One of the main components of the IDA assistance was directed towards the Madras Urban Development Projects, Phase I (1977 - 1981) and Phase II (1981 -1985). The resources were used to develop sites and services schemes and slum upgrading schemes within the MMA. The construction of a Inner Ring Road to connect the three National highways and improvements to the transportation sector by improving the bus fleet was part of the agenda. The second project is an on-going one and is called The Tamil Nadu Urban Development Project (1988 -1994). This World bank assisted project extends the components of the MUDP projects to the entire state covering, in addition to the MMA, nine other urban agglomerations which each have a population of over 200,000. The Tamil Nadu government has appointed the MMDA as the monitoring agency and coordinating agency for development within the MMA. The entire project is being monitored by the Project Monitoring Group, PMG. The Secretary, Department of Housing, is the Chairman of this Group. It is important to note that the current secretary was the former Member-Secretary of the MMDA. The third project undertaken through this funding is the Mass Rapid Transit System (MRTS). MMDA has also been appointed as the coordinating agency for this project which involves the laying of a Rapid Transit Line from the Central Business District to the dense developments in the south.

3.3.3 The Area Development Unit

This unit develops special projects that are considered innovative and in the words of the the Vice Chairman of the MMDA. "We do these projects when no private or existing public agency comes forward to undertake them, when there is no set precedent."

These include the construction of a Whole Sale market complex (vegetables, fruits and flowers), an Iron and Steel Market and a Bus and Truck Terminal at the periphery of the urban area. This is part of the proposal to reduce the congestion of the central business district by moving out the above mentioned activities from the area. The proposal will also reduce the number of commercial vehicles entering the city to deliver these essential goods. Presently the MMDA is involved in negotiations with the representatives of the various interest groups who will be affected by the move based on an incentive package that the MMDA developed and presented to these groups.

This unit is also involved in the creation of new urban nodes by laying the infrastructure facilities and developing State owned land for residential use as proposed in the First Master Plan and the design of a new town around an industrial complex located to the north of the city which is one of the urban nodes.

Planning agencies working in the metropolitan area do not communicate very well. Where the institutional channels exist, the agencies have a tenuous communication link. The MMDA has been created as coordinating and monitoring body and in this next section, I will describe some of the strong and weak connections that it maintains with other agencies.

3.4 Profile of Planning Agencies interacting with the MMDA

The MMDA interacts with many agencies in the process of carrying out its functions (Sivaramakrishnan, 1986). The most important among them are:

1] The Madras City Municipal Corporation
2] The Tamil Nadu Housing Board
3] The Tamil Nadu Slum Clearance Board
4] Housing and Urban Development Corporation
5] The Town and Country Planning Board

In addition, there are other agencies which operate within the metropolitan region and these have a tenuous link with MMDA. These include:

1] The Madras Metropolitan Water Supply and Sewerage Board, MMWSSB
2] The Pallavan Transport Corporation, PTC
3] The Tamil Nadu Electricity Board, TNEB
4] The four municipalities, four industrial townships and sixteen Town Panchayats who are physically located in MMDA's jurisdiction but have their own administrative powers.

3.4.1 The Madras City Municipal Corporation (MCC)

One of the most important and oldest of all the local authorities, the Madras City Municipal Corporation collects its revenue from property taxes, profession taxes and other small taxes. It is currently headed by an appointed Commissioner and a Special Officer, both bureaucrats. It is intended to function as an elected body. However, elections to the Madras Corporation have not been held for the past fifteen years. Since the creation of the MMDA, which now controls and guides all development in the metropolitan region, which includes the city area, its importance has declined considerably. In 1978, the revenues accruing from the water supply and sewerage were transferred to another agency, (the MMWSSB) and this is one of the reasons for a decrease in revenue collections. Its main source of revenue, the property tax yield has declined drastically over the years due to underassessment and poor collection. The Commissioner of the MCC is on MMDA's Board and provides the link between the two agencies. The MCC is entrusted with the maintenance of urban services within the city.

3.4.2 The Tamil Nadu Housing Board (TNHB)

This is a state level agency established in 1961 and it operates within the metropolitan area it is responsible for the development of all state government sponsored housing initiatives. It was one of the first agencies to construct housing and make available serviced sites on a large scale. Its housing units tend to be expensive. Through the MUDP programs, the Housing Board redirected its investments to providing shelter for the Economically Weaker Sections (EWS).

The TNHB was the implementing agency for the MUDP 'Sites and Services and Squatter Upgrading' schemes that were coordinated through the MMDA.

3.4.3 The Tamil Nadu Slum Clearance Board (TNSCB)

This board, established in 1971, undertakes all activities concerning slum clearance, improvement and resettlement of slum dwellers within Madras city. It originally attempted to remove the temporary housing (squatter settlements) and rehouse the people in high rise structures in the vicinity. This program is considered a failure because of lack of sensitivity to user needs and preferences and high costs (Ramasubramanian, 1989). The Board, while retaining its name, has given up the idea of 'clearance' and has taken upgrading of existing slums as its agenda.

It served as the implementing agency for the World Bank funded programs in identifying potential beneficiaries and evaluating their needs through which it has established a link with MMDA. The agency has a limited computer capabilities.

3.4.4 The Housing and Urban Development Corporation (HUDCO)

HUDCO is a financial institution set up at the national level and has the organizational capacity in the form of technical,financial, construction, legal, and economic expertise to formulate , implement, and monitor housing and urban development schemes financed by it. The TNHB is one of its biggest borrowers and as part of the monitoring process HUDCO comes into close contact with the MMDA. This agency is focussing presently on appropriate technology and low cost construction techniques to increase the housing stock in the country. It advocates low rise-high density housing in the urban context.

HUDCO undertakes counselling and guidance on house finance and construction. It uses computers intensively for its day to day operations which involve project monitoring and financial management.

3.4.5 The Town and Country Planning Board

Through the amendment of the 1920 Town and Country Planning Act, this Board came into existence in 1972 and develops plans for the state outside the metropolitan areas. It develops plans for regional and state levels and advises local authorities on the nature of development of their area. It collaborates with many state agencies in data gathering efforts and has an extensive data base of information related to spatial planning.

The Town and Country Planning Board has developed a strong computer capability to conduct suitablity analysis using a personal computer based GIS.

3.5 Present Status of MMDA

MMDA has been perceived by the World Bank as being effective in achieving progress in its stated goals and objectives. It has constantly been compared to the Calcutta Metropolitan Development Authority and rated favorably (Sivaramakrishnan, 1986). However, in recent years, there are some doubts being raised about the actual degree of success in targetting beneficiaries because most of the 'Sites and Services' plots intended for the economically wealer sections are owned or occupied by middle income families (Haines Interview, 1990).

In the next chapter, I will discuss the observations that I made during my field trip, comparing the stated objectives as described earlier in the chapter with the reality. For example, the MMDA now concentrates on its planning permit sanction function to such a great extent that the memebers of the public refer to it as a "Sanctioning Authority", its planning and developmental role being mostly forgotten. It has entered the implementation game even though it does not openly describe itself as being either an implementing agency or a regulatory agency. These changes that have taken place over the years affect the organization and the field research will describe how the agency functions today.

Chapter 4

MMDA 'S WORK IN ACTUALITY

In the last chapter I described how the MMDA was set up under the auspices of the Town Planning Act of 1972 when the Government of Tamil Nadu decided that an umbrella agency was required to address the problems of the metropolis which due to rapid growth and urbanization had spread outwards from the originally defined city limits. In chapter three, the description of MMDA was largely based on secondary material and was descriptive of the agencies stated objectives which are:

1] planning for the physical infrastructural and economic development of the Madras Metropolitan Area and enforcing the Master Plan for the MMA and the Development Control Rules which were framed under the Master Plan,

2] formulating, monitoring and coordinating projects for metropolitan development aided by the State or national Government or external institutions,

3] promoting civic development projects for planned and orderly growth.

In this chapter, I will describe the actual work process in MMDA based on my field research and interviews, then compare them with the stated objectives, and explain the internal decision making structure within the organization.

4.1 Objectives of my Field Visit.

By spending time at the agency I ascertained the actual nature of the work undertaken by the MMDA and could compare it with their stated objectives. As a former resident of the city, I had had contact with the agency in a variety of ways, as a client for services , and as a student seeking information and data about certain projects. I had not studied the organization itself before. I spent three weeks in Madras, during which time I interviewed twenty people within the agency and twenty hours observing the day to day working of the MMDA. In the next section I will summarize my observations.

4.2 Description of Actual Work Process

4.2.1 Permit Processing

My observations indicted that the most important activity that occurred in MMDA was the processing of planning permit applications. MMDA receives as many as five thousand applications a year and thus it did not seem to be surprising that this was the case. However, the number of files pending at each level of decision making and the number of personnel involved in this activity seemed disconcertingly large to me. The staff were clearly overloaded and were handling the files in a cursory manner, just trying to cope with the volume of work. I remembered the comments that I had heard about the role of MMDA which had been reduced ".....from a planning and development agency to one that spent time stamping papers required to commence development."

The average time taken for an application to be processed extended from three weeks in exceptional cases to three months according to the rules, but the staff hastened to tell me that six months was a more reasonable time frame to expect a written grant of permission. This appeared to be a reflection of the work load as well as the complexity of the process.

It is very interesting to note that all levels of officers are involved with the planning permission process. The decisions on planning permission, violation/exemption are usually handled by the technical people and further clarification or arbitration goes through the organizational hierarchy. Many decisions eventually reach the Vice Chairman's notice because at each level, a denial may be appealed up the hierarchy.

Former Member Secretary and currently, the Secretary, Department of Housing, Mr. L.K. Tripathi says, "The image of MMDA in the minds of the people of Madras is made or marred by the efficiency of the planning permit sanction process."
The Vice Chairman told me that about thirty percent of his time every week was taken up by parts of this process.

4.2.2 Enforcement

Regulating development through the enforcement of the development control rules has become an important part of MMDA's functions. The enforcement division periodically surveys permitted development to scrutinize its conformity with the sanctioned proposals. Violations are brought to the notice of owners/developers, and warning notices are issued. If there is no satisfactory response, then demolition notices are given and the MMDA can legally proceed with demolition to ensure that the development conforms to approved specifications.

In practice, it appeared that the MMDA was working with its hands tied behind its back. An owner /developer could legally appeal to stop or stay the proceedings initiated by the MMDA. This court ordered stay of proceedings operates only against the MMDA from proceeding with demolition and does not operate against the owner/developer from proceeding with construction. Once the building is completed the MMDA is compelled to grant an exemption and legalize the development, it becomes a 'fait accompli'. In some cases a fine is collected as a charge for violation of the rules but the amount involved is so little that many developers willingly pay the fine.

The Authority is portrayed negatively in two ways. First, when the general public observes large scale development flagrantly violating the rules and forms a very poor opinion of power of the Authority. Second, when the MMDA actually proceeds with demolition, it raises a public outcry, being seen as a power hungry, ruthless agency which works against the masses. In addition, the developers almost never conform to the development control rules.

These rules are very complex and are open to interpretation. However it is a very difficult document for a average Madras citizen to understand. A counselling and consultancy center was set up in 1987 to interpret the application form and the development control rules for the users. This center explains MMDA's existing Master Plan land use proposal and defines the acceptable nature of development in any

specified area. About twenty five queries in person and some written queries are received and dealt with every day (Doss Interview, 1991).

4.2.3 Development Planning

The Master Plan Unit was readying itself for the preparation of the Second Master Plan. Land use surveys had been completed for about twenty-five percent of the metropolitan area. The survey was to update the MMDA's record of existing land use trends within the metropolitan area to assist in preparing a Master Plan that was closer to reality, since much development that had occurred was not in accordance to the First Master Plan. Other than this survey there was little activity within the Master Plan unit.

There was a study being conducted by MMDA in collaboration with the Times Research Foundation, a local non profit foundation. This study was intended to identify and report on various factors influencing the land use. This year long research effort was not within MMDA and hence no one but a couple of senior officials knew anything about it. The officials who talked about it said that the final seminar, a presentation of the findings of the research was meant to be held in February 1991. The presentation of the seminar was postponed to June 1991 due to the national governments decision to ban all seminars conference until further notice due to the War in the Persian Gulf.

The existing land use map that the MMDA has as its reference a base map that was prepared in 1975. Pending the preparation of the new land use map, MMDA has to reclassify some of the land uses to reflect current development. For example, many areas within the metropolitan region classified as agricultural land are now residential estates. When owners/developers intend to start construction for purposes other than the classified use, they seek reclassification based on the existing trends. This division also fulfills this function, processing about seventy-five applications per month.

4.2.4 Construction

In the hierarchy of work processes, I saw the next emphasis being placed on the process of relocation of the wholesale markets outside the central business district. The MMDA was involved actively in the negotiation with the traders and businesses who would be displaced. The MMDA has also undertaken the construction of these projects. When MMDA was set up, it decided not to get into construction activities like the Calcutta Metropolitan Development Authority had done and it had been widely acclaimed for this decision.

I asked the Vice Chairman why this sudden shift of policy had occurred. His reason was that they did not find private developers coming forward to take up what he called *'innovative projects'*. While there was an entire division formed to take care of the construction process, I did not find anyone working on proposals for the use or rehabilitation for the space to be vacated. This vacated space would probably be of very significant commercial value, being in the center of the financial and business district. There was a division working on 'new towns', though the work was of a preliminary nature.

To sum up, it appeared to me that MMDA was largely synonymous with permit sanctioning, and to a much lesser extent with planning for the future development. I will now discuss some of the organizational processes that seemed different partially or completely askew from the stated descriptions in Chapter Three

4.3 Organizational Issues

4.3.1 Economic Development vs Spatial Development

The MMDA set out to achieve overall development of the MMA which included economic development. Presently, the authority is not able to do anything more than land use planning or spatial decision making or policies concerning land use and redevelopment based on their view of the nature of development. What actually happens is that the Central or State government makes a decision that goes against the

grain of these guidelines put forward by MMDA which is in a quandary of not being able to take a definite stand.

A classic example of the failure of MMDA to adequately fulfill its goals is the preparation of the First Master Plan document. The First Master Plan exercise resulted in such a philosophical document that a structure plan had to be prepared to proceed with developmental efforts. Recognizing the deficiencies of the First Master Plan, the Second Master Plan effort is spending time to understand how the Land Use policy can be sensitive to the needs of the metropolitan area while following national and state guidelines for development. The Second Master Plan effort appears to be going in the same direction of the first due to two reasons:

1] The nature of the Master Plan document is such that it can specify only the broad guidelines for development which have to be then interpreted and explained for practical use through innovative development control rules and zoning guidelines.

2] There is no evidence of a common vision or a more specific set of goals and strategies and alternatives to address problems identified. While no researcher is an expert on the every sector of metropolitan management, the individuals are expected to come with solutions in their own field of expertise such as power or water supply and a compilation of these solutions is expected to benefit the whole. What is missing and is a crucial element is the coordination (even of these research efforts) in their attempts to solve the existing problems. MMDA's organizational strategy is flawed because the people working on power supply are not talking to the power distribution and maintenance people , let alone the water supply or the communications people.

4.3.2 Inter Agency Coordination

The MMDA attempted through its creation a coordination of the various agencies operating in the metropolitan region to better serve its users. However, it has failed to do so. The other agencies do not seem to heed the MMDA's directives regarding policies, the agencies who condescend to listen to the MMDA come across as doing a favor for the MMDA by obliging them.

For example, the Electricity Board, TNEB, operates and controls power generation, transmission and distribution over the entire state , a small portion of their energies are directed to dealing with the metropolitan area. When TNEB decides to establish a substation or transformer, it uses the services of its own planners and engineers to install facilities. The location of such facilities and the prioritizing of one project over another depends on guidelines or long range plans set by TNEB. In many cases, it does not conform to the plans of the MMDA. If a major problem arises, the Vice Chairman or the Chief Urban Planner of MMDA speaks personally to the Chairman or Chief Engineer of TNEB and they work out a compromise.

Thus the MMDA has no legal or political power to ensure that the plans it makes are conformed to by the other agencies. There is a mechanism of coordination of the different agencies, senior officers from all the important agencies sit on MMDA's board. I was told that many of these people do not attend meetings and do not actively participate in the planning process. The only regular attenders are the people concerned with the shelter sector. The sectors that often go unrepresented are communications, transport, power, public works and industry.This is because the MMDA is a conduit for the World Bank's funding and the implementing agencies are the major shelter providers, (e.g., Tamil Nadu Housing Board and the Tamil Nadu Slum Clearance Board). However, the TNEB has its own funders, sometimes receiving monies directly from the World Bank. Even if there is coordination as far as the World Bank projects are concerned, there is no link otherwise.

4.3.3 World Bank funded Projects

Projects funded by the external agencies like MUDP and TNUDP are coordinated through the development planning unit. The MMDA was completely in charge of the MUDP projects and were very involved and busy during that time (1975 -1984). For the TNUDP, the MMDA is involved only with projects in the Madras Metropolitan Area. The project is headed by the Project Monitoring Group and the MMDA's role in this project seemed marginalized. I understood through discussions with MMDA personnel that the composition of the Project Monitoring Group had many old hands of MMDA in different capacities and that there was an informal link

between the two agencies. The PMG appeared to be more powerful because they reported directly to the funders, the World Bank. The TNUDP projects were being implemented and were proceeding on schedule.

4.3.4 MMDA and the Madras Corporation

The Madras City Corporation, MCC is more than three hundred years old. It was the final arbiter in the city's development. The MMDA was created when the City Corporation had no elected decision makers and therefore I argue that had the MCC been in power, the city would not have allowed its power to be stripped away completely by the MMDA. Right now, even the city's residents regard the Corporation as a defunct organization. Elections have not been held for fifteen years,the low paid staff are corrupt and inefficient and they have no power to control anything.

The service provision load is the burden of the Madras Corporation whose revenues have fallen drastically. Even the biggest earner, the property tax, is not being administered efficiently. The under staffing that has taken place in the Corporation is also partly responsible. The Madras Corporation has no incentive to provide adequate services because they do not earn much revenue from service provision. However, as far as the city area is concerned, they are in a position to coordinate services better than MMDA because of their scale of operation which is at a more disaggregated and micro level.

Again, the coordination of the MCC and the MMDA is set up to be in favor of the MMDA and has evolved through the informal bureaucratic network, rather than the established formal channel. In particular, the planning permission process gives an insight into the workings of the system. The MMDA gives a client permission to develop his land. Before commencing with the development, the client has to get permission from the Madras Corporation to ensure that she receives the service connections. The MCC ratifies all the permissions given by the MMDA. The system is set up so that in some cases, the Permission is granted at the MMDA itself. It is impossible for the MMDA to keep track of the number of service connections

provided, the load on the system and the capacity of the distribution networks etc. and this leads to excessive development based on the broad zoning guidelines, without taking into account the existing infrastructure. When systems break down, the MMDA does not concern itself with the consequences.

4.4 Decision Making Process Within MMDA

The MMDA's decision making Board is headed by the State Minister of Urban Development and he or she is assisted in this task by the Vice Chairman and the Member -Secretary. In reality, these two state appointed bureaucrats are responsible for guiding MMDA's major policy decisions. The Vice chairman is responsible for the broader issues while the Member-Secretary is closer to the day to day administration as well as the planning permit sanction process. At the time of my visit, the post of Member secretary had fallen vacant and the vice chairman was holding additional charge. Their knowledge of the specific role of MMDA is limited and is usually acquired through briefing of the Chief Urban Planner and other senior planners within MMDA.

While the bureaucrats hold office for a maximum period of three years, the other officials are permanent employees of MMDA. Policy decisions are made by the board. However, it actually works with a large section of the board being unavailable or available but passive observers. There is very little scope for public participation in this set up. Different professional entities like the Council of Architects and the Association of Town Planners are acknowledged and asked to present their views only after the MMDA has spelt out the agenda for a certain development and not in the initial stages of determining the nature of the development.

The technical division is structured (Figure 2) and progress up the career ladder is primarily by seniority. The Chief Urban Planner takes responsibility for the technical decisions being made and usually determines the direction that the agency should take in the form of projects and programs. Each of the divisions mentioned in Chapter Three is headed by a Deputy Planner. There is a large pool of labor under the newly developed construction wing.

The Chief Urban Planner appeared to wield a lot of power within the agency, In fact, the junior staff viewed the C.P as he is referred to as more powerful than the Vice Chairman or the Member-Secretary as far as their work was concerned.

4.5 The Decision to Introduce Computers

MMDA decided to introduce computers in 1989. I attribute this decision to the following reasons:

1] The operations division of the World Bank had constantly been pushing the use of computers for accounting and audits and other planning functions. They had earmarked funds to be used for the purchase of computer equipment and software.

2] The Vice Chairman of MMDA was formerly Chairman of the Electronics Corporation of Tamil Nadu, and he was used to working with personal computers. He thus moved the effort and encouraged it avidly. The Chief Planner could influence decisions taken by the board, I believe, the computerization process was pushed through the Board because of his strong recommendations.

3] MMDA has been lucky in having like minded administrators over the past few years. The previous administration had initiated this computer effort and a preliminary user needs assessment had been completed.

4] Last but not the least, the then senior planner in charge of planning permits wanted to have something to lighten his workload, mainly keeping track of planning permits and their sanctioning process.

Thus we see that there was a decision made to introduce computers into the agency before attempting to find out if there was a need for its use. It may be in fact a justifiable acquisition but a lack of planning for its arrival was visible in MMDA. There was not enough clarity in everyone's mind about the reasons for its sudden introduction. From my interviews with the previous decision makers at MMDA, I had come to know that this proposal was in the pipeline for a long time. Despite this, there was no proper user needs assessment done.

4.6 Impacts of the Computerization

In the next chapter, I will discuss the actual uses and applications of computers within MMDA. Simultaneously, I will be summarizing the interviews that I conducted so as to present the points of view of different interest groups within and outside the organization. I will specifically focus on computer applications which would benefit from some kind of spatial analysis. I see the present applications as a forerunner to acquiring a GIS. The nature of such a GIS, and impediments in setting up a system, will be discussed in the forthcoming chapters.

According to the Chief Urban Planner, the kinds of questions that will get raised using a GIS will be beneficial to the organization which will then move MMDA towards a different plane involving more research and analysis. For this reason, an understanding of the present efforts at computerization become important.

Chapter 5

CRITIQUE OF MMDA'S COMPUTERIZATION EFFORTS

In Chapter Four, I discussed the field observations to understand the actual working procedures of the MMDA. In this chapter, I will examine the introduction of computers into MMDA. First, I will trace the evolution of the computer operations, describe the nature of its development, and identify the number of personnel involved. Second, I will attempt to assess the potential impacts of computerization on decision makers, planners and others connected with the agency which will help me determine the potential GIS users within the agency. Looking at the technical and the organizational constraints under which the systems operate will define the problems that are likely to impede a fledging GIS implementation effort.

5.1 The decision to introduce Computers

MMDA decided to introduce computers into the organization in 1989. The Board identified three areas where computers would be of maximum use in the organization. These included: 1) a process to track the files relating to planning permit applications, 2) an inventory of the land uses within MMA, and 3) a computerized audit and accounts process (Subash Chandra Interview, 1991). The board made this decision after discussions with the technical and administrative personnel, but the final decision came from the Vice Chairman.

As I have described in Chapter Four, the most important activity that the MMDA currently undertakes is the planning permit sanction process. Handling the large number of applications is a very difficult task, but even more problematic is keeping track of each application. Hence the relevance of the first computer application, which is a file tracking system designed to assist MMDA's senior officials. The second computer application is a land use inventory which is intended to help members of the public and developers in making their proposals compatible with the

vision of the Master Plan The third computerization application is the automation of the payroll system. I will discuss each computerization process briefly.

5.2 Description of the File Tracking Process

The file tracking process in MMDA, as presently implemented, attempts to establish the status of a particular applicant's file. Through a pre-designed query, information on the name of the applicant, date of application of planning permission, nature of the development for example residential/commercial/layout etc., special conditions attached to the development and its current status can be ascertained. The referencing is by street address and the unique geo-referenced identifier is the revenue survey number which is the basis for the maintenance of land records and for the collection of property taxes. There are two major users of the system:

1] the counselling and consultancy center at MMDA which can deal efficiently and effectively with enquiries from the general public about the status of their application;

2] senior officials involved with the general planning permit sanction process who can bring up the relevant records on their computer screens for review and discussions, preventing unnecessary physical file movement.

5.2.1 Manual Process and its Automation:

Prior to introducing computers a similar process occurred manually. There was a file called a 'movement register' which literally recorded the movement of the concerned files through the organization. It recorded the number of the file, pertinent information about it, the date of beginning of the processing, and dates of completion of every stage of the process that a normal file has to go through. The Vice Chairman (Subramani Interview, 1991) says that the present computer effort, as far as permit tracking goes, is only an automation of existing processes, fitting neatly into Huxhold's lowest level of the pyramid - Operations (Huxhold, 1990.)

5.2.2 Facilitating the Automation of a Manual Process

The MMDA had employed the services of a consultant, also a state agency, to select the system , install the hardware and the software, and then educate the users about the working of the system. The consultants, Infotech Ltd, completed interviews and surveys of the staff to determine the key stages of paper file management within the system. Currently all data is being entered into the computer by one or two operators and these persons are the liaison between the different groups of potential computer users within the agency. The system has not been set up so that every person can update the records of the files they scrutinize. They have to be updated only at a single point, through a systems operator who is familiar with the structure of the data base and the files.

To make this automation effort possible, the MMDA management had instructed that each time the file reaches a desk of a planner or administrative assistant, they sign a paper attached to the file indicating when they had received it and once again when it leaves their hands to sign its movement from their desk. This information is updated every week so one can get a record of the file's actual movement and current location. The system was in operation during my field visit in that all the active files had been added as records and the staff concerned with these files were being instructed on the importance of signing and returning the receipt and clearance forms for these files. That was key to the success of the tracking system.

5.2.3 Observed Contradictions in the Permit Tracking System

It is reasonable that the MMDA chose to look at the permit tracking process in an effort to speed it up because of the image and the impacts that the operation has on the general public (Murali Interview, 1991). However, the MMDA has just taken the manual procedure and attempted to automate it. The deficiencies that exist with the manual operation (Figure 3) will continue to plague the computerized operation. In addition, the dependency on the persons taking care of the files to provide additionally the particulars of movement of the file is already slowing down the system.

As a consequence, though the data entry of all current planning permit applications has been recorded, the process of updating their progress is proceeding at a very slow pace. The manual system which is the basis for this design has been given up over the years and at present the concept exists only in theory and not in practice. If the manual system did not work, I believe that the complexity of the set up could bring the system to a grinding halt unless:

1] the deputy planer in charge of this process is inclined to foster this method by special techniques and incentives and that MMDA's management continues to be interested in computerization; and

2] the process itself is easy to operate and flexible enough to make the personnel in MMDA want to operate and use the system.

The way the system is set up now, I don't see that happening because the very fact that all records have to be listed and then entered into the system by one operator is adding a complication into the system. It is also making the computers inaccessible to a large group of people , the hundred odd people that are connected with processing of these files and applications, and is permitting access only to the computer operators or programmers.

A good way to set up the system would be to have a central file server which would then make it possible for individuals scrutinizing files to pull up the relevant records and make updates in certain fields, locking some fields so that they cannot be tampered with or accidentally modified. Allowing individuals to update the records they work on prevents them from feeling as if they are being watched. It offers the benefit of organizing their work more efficiently and hence adds as an incentive to learn to use the system.

5.3 The Land Use Database

The second area of MMDA's involvement with computers is the creation of a Land Use Inventory for the entire metropolitan region. Intended to be used primarily by the Counselling and guidance center of MMDA, this data base will indicate:

1] the physical location of the parcel of land, delineated within the city area at parcel level and in the rest of the metropolitan area by the revenue survey unit which gives the information about the ward and census division;

2] the land use that MMDA has classified according to the old Master Plan;

3] forthcoming approved changes , if any;

4] the F.S.I and the other development guidelines;

5] other conditions associated with the land parcel that is known to MMDA, for example; the concerned site might be a part of a bigger residential or industrial layout. The data base will indicate if the layout had been approved by MMDA or not , which might have a bearing on the individual's plot of land in that, in the event of his or her becoming an owner, any action taken against the layout would affect him or her first and not the developer, because it is owner's responsibility to make sure that the land had been approved by the MMDA initially. This is a mechanism for potentially counter checking the developer's claims to the property.

The present system has developed as a multi-user system running under the UNIX operating system in the UNIFY Relational Database environment. The system has provided for interactive data entry and query facilities with report generation capabilities. Each parcel of land is identified by a key which has the following structure: Taluk number, Village Number, Block Number, Survey Number, Sub-division Number/s. Each parcel of land can also be associated with multiple records with reference to ownership and extent, acquisition, land use, map reference, linear features and spatial features. The Survey number is the unique identifier for every parcel of land within the Madras metropolitan area and is used for land records and revenue assessment purposes by other departments.

At the time of my field research, this system was being set up but had not become operational and accessible to the public. Planning permit sanction staff will also use this data base so they will know what the limits and specific conditions are and check the plans accordingly. Though the system has not become operational, in my interviews I talked to the people working at the counselling division and the planning permit division and they did not seem to have any problems with understanding the concepts of the system design.

5.4 Computerization of the Audits and Accounts Process

This was the third area of concentration for the computerization process. The system helps the administrative personnel in charge of pay roll, accounts , disbursements and others to work more efficiently because of automation of the process. The process has been standardized in other agencies and there are no problems foreseen with the effective implementation of the process. I have not delved into its operation because I felt that it was peripheral to my area of interest, namely the implementation of the technology for planning related applications. It appeared, from my discussions with the staff, that this system was organized easily because it is used by a specialized group of people, use of the system is specialized, and does not interfere with the regular day to day applications of the organization. They also do not have any contact with the public who come to MMDA for their various purposes.

5.5 Impacts of the Computerization Efforts

In MMDA, only a small core group of persons was very involved with the computerization efforts. They were the Vice Chairman, the Deputy Planner in charge of Computerization and his assistants. This core group worked with the consultancy group, Infotech Ltd. through their representatives.

As the system is being set up, there are a couple of planners who are currently using the computers because the Vice Chairman has given them the opportunity to explore and use the programs like Lotus and dBase 3+ for project specific personal computing . For the most part, MMDA's personnel were aware of the computerization process going on within the agency. The interesting point was the lack of expressed curiosity about the subject. There was no concern about its impacts, it was just happening. Each group, however, had felt the impact in a certain ways to a greater or smaller extent. The fact that the impacts were being felt came through in the interviews. I will discuss the different interest groups' opinions in the coming sections.

5.5.1 Impacts on Decision Makers

As already observed, the Vice Chairman is the 'Champion' of the computer effort within MMDA. His reactions were fairly straight forward. He felt that in the light of the functions that the MMDA was presently carrying out, file tracking was a priority. He also indicated that it would be able to make the processing easier for the staff as every file would not have to be physically moved to his desk for reference and that key information could be accessed by him. He had a personal computer on his desk and he had his own data base of current files that were at his desk pending a decision, drawn from the main data base.

5.5.2 Impacts on the Division of Computerization

As can be expected, this division, starting with the senior planner in charge, were very pleased with their achievements. They were busy, and were suddenly the elite of the organization. The senior planer had a much greater access to the Vice Chairman because the project had his support. However, the difficulty they were facing was motivating everyone to use computers. There was little they could do to get the older people involved with computers. Even the younger people who knew how to use computers were not overly concerned about the advent of computers because they did not see direct computer based applications in their day to day work.

5.5.3 Impacts on Area Plans Unit

The division most unhappy about the computerization effort was the very division which is expected to use the computerization effort to large extent - the division that issues planning permissions. They were upset for two reasons: first because of the additional workload that is created with the recording process that is essential for automation and second, because they did not see any tangible benefit to help them because of the use of the system. "Do you think this system is going to help us to make a better decision or the same decision quicker? - No! (Anonymous Planner Interview, 1991)". They also felt that this system will be used to watch over them in an effort to increase efficiency and thus were resentful about its introduction.

The planners in the planning permission division feel threatened by the adoption of the file tracking system because it is a reimposition of the manual system in a different form. The manual system has been allowed to slowly fade into oblivion and there is the potential that the system could do the same with the computerization effort as well.

5.5.4 Impacts on Agencies Interacting With MMDA

A significant opinion that staff of other related agencies had on MMDA's computer efforts was that it was a Public Relations effort, and therefore somehow was interpreted as less serious, and not a feature that would help the organization except from the stand point of public perception. Some agencies' spokespersons felt that MMDA should have invested more resources into computer facilities and training that would help the organization better. This is even considering that the permit tracking process is primarily designed to help the organization's efficiency. The reason for their viewing permit tracking with disdain was that they generally felt that permit tracking was not what MMDA should be doing as a priority anyway.

Many agency spokespersons questioned MMDA's hang up with certain things without doing the visionary and idealistic role that it was suppose to play. Other agencies felt that the bureaucracy within MMDA would play havoc with the computerization process akin to what had happened in Housing Board a few years ago, where currently the computers continue to being used only for the audit and accounts process.

5.6 Linkages between Planning Problems and Current Computerization Efforts

I would like to interject at this point some of my opinions and observations about the computerization process. The fact is that MMDA is doing a lot more planning permit sanctioning than it anticipated as part of its mission.
This means that a lot of their resources are being spent on doing this particular job. While it seems appropriate that MMDA has chosen to address planning permit as part of its strategy to increase efficiency the real problem of "automating the process" itself

has not been addressed enough. I feel that the land use data base development is a feature that is more in line with MMDA's interest to monitor the development of the metropolitan area. More attention should be given to the development of this part of the computerization process because it is this feature that can link up easily to a GIS. The computerization of the audits and accounts section is a related effort which is intended for maintenance purposes and does not directly help MMDA's spatial planning efforts.

In Chapter Three we addressed the problems of metropolitan management that MMDA must address. I feel that most of the planners are stuck with administrative duties tied up with permit sanctioning and therefore are not able to devote much time and energy to other decision making and design issues. Given the nature of the problems that MMDA is dealing with, computerization is by itself not a solution, however the work they are doing can be facilitated by the use of GIS technology, (e.g., the time freed up by automation could be better used for more detailed analyses).

MMDA needs to do something beyond permit processing, than they have been doing so far and for the kind of analysis required to design and implement meaningful intervention, they require the use of a better system to understand and manipulate information. GIS is suited for this purpose, but the introduction of the system brings with it a set of benefits and constraints that I will discuss in Chapters Seven and Eight.

5.7 Costs Involved

The World Bank funding for the Tamil Nadu Urban Development Program has some resources for technical assistance written in to the project. Since the technical support of the entire project is being provided essentially from the metropolitan region, there is a resource pool available to set up the initial effort. However, as far as the question of sustainability is concerned, the project must finance the initial start up costs for a GIS. My interviews with the World Bank personnel indicated that the Bank was inclined to look at acquisition of a GIS by a metropolitan planning agency as a useful investment which contributes to the institutional building efforts that it seeks to promote through its projects. Madras has always been looked at favorably as far as

performance characteristics go, and the Bank intends to use the Madras experience as a pilot for promoting the use of GIS in other areas in India and other developing countries (Rotner Interview, 1990). They see GIS moving the agency to more research and and analysis and helping the decision making process be less arbitrary and more responsive to community needs.

In the next chapter I will present a synthesis my field research efforts which through personal interviews discussed the potential mapping needs of the agency. I will also present the different responses to the relevance of using a GIS for MMDA.

Chapter 6

INTERVIEW RESULTS AND SYNTHESIS

In the previous chapter, the description of the computerization efforts currently underway at the Madras Metropolitan Development Authority indicated that the foundation to sustain a more intensive computer effort is currently available and that the organization appears to have the potential to use some form of a Geographic Information System.

In this chapter, I will synthesize the interview results which will lead to an analysis of the potentials and constraints to implementing a GIS in MMDA. First, is a brief description of my research strategies for the interview stage of my work and a synthesis of the findings of my field research. These findings from primary interview data are key to my conclusions about the 'benefits' and 'constraints' to a GIS being adopted. The interview results also give a more detailed picture of MMDA's interaction with other departments operating within the Madras Metropolitan Area from an organizational standpoint. Another interesting finding described in this chapter is the mapping of formal and informal networks of communication within and outside the organization.

Interviews with other organizations involved with the use of computer based applications to planning yielded information about different agency responses to computerization. These agencies all had connections with MMDA and interviews with their staff yielded other perspectives on MMDA and its processes.

6.1. Interview Step

The interview protocol was undertaken at two levels. The first set of questions determined the mapping needs of each division within MMDA and possible overlap with any other sections/divisions. Specifically, questions used examples of tasks

which fell into the categories of operations, management and policy. The second set of questions assessed the interviewees views on the potential impacts of GIS adoption within MMDA , with an emphasis on their individual perceptions and the impact of their past experiences with 'new innovations'. It was an appropriate time to do this investigation as MMDA was just completing its one year effort at installing computers in the organization and the process established was clear in everyones' mind. In the other agencies interviewed the same procedure was followed, with additional emphasis on the inter agency coordination and other policy formulation issues that were relevant to the other agencies' missions.

The interviews were conducted in English, though very often, the discussions were in the local language, Tamil - thus some of the quotes are translations of the actual statements. The interviews were spread over two weeks and my personal interest in GIS was carefully concealed during the initial stages of my interviews to minimize interviewer bias.

6.2 Interview Observations - Mapping Needs

In this section, I will discuss the perceived mapping needs of MMDA on the basis of my discussions with various staff in the agency, starting from the top of the organizational hierarchy with the Vice Chairman, and ending with the lower-level staff (draftspersons).

Vice Chairman, MMDA

The Vice Chairman spoke about what he referred to as the 'strengths' of the agency in terms of the availability of maps and their accuracy. He pointed out that the agency had access to the Survey of India's maps which were drawn at a scale of 1: 25,000 (verify units) and in addition to maps in three scales, i.e.,. 1: 10,000, 1: 4000 and 1: 2500. The village maps were drawn at a much more detailed scale, 1" : 32'. The MMDA had access also to the satellite images at 30m resolution and SPOT images at 10m resolution from the INSAT 1B satellite.

He did not discuss each section's mapping needs but instead concentrated on explaining his quest for an ideal mapping software package through which he had first been introduced to GIS. He said that he along with senior planners within the agency were looking for a **'dynamic modelling tool'.** He said that the mechanism for the storage and retrieval of paper maps to be given to planning permit applicants and potential developers was so well perfected and organized that it did not require automation.

The problems that currently plague the system are updating and accuracy of information portrayed on the map and this, he pointed out would exist with the computerized system too. In addition, the comparative advantage resulting from use of an electronic storage and retrieval system for all the maps presently available in MMDA would be negligible, if not nonexistent, because most maps would be used only a few times and it did not make economic sense to invest resources to digitize them or somehow store them in machine readable form. However, he said that he would work on digitizing a set of base maps at a larger scale which would help in regional analysis and forecasting. He intended to train and use the large mapping section, about two hundred people, within MMDA to undertake the digitizing and updating process.

The mapping software that he saw the agency using was one that helped identify ideal solutions to road alignment and housing layout problems, given a set of constraints. For example, the mapping software should be able to help identify the most efficient road or street pattern that should be developed, given a set of constraints such as minimum road width, least deviations from a selected route, etc. He emphasized the point that he did not want the computer generated model to be the final solution, as often political or economic constraints determined the implementation. The computer generated solution would be the basis of discussions, negotiation, and give opportunities for further study if required.

In summary, the Vice Chairman and the senior most decision maker in MMDA saw computer generated solutions as the basis for evolving innovative solutions for the planning tasks that MMDA is involved in.

Chief Urban Planner

The Chief Urban Planner is the senior most technocrat within the agency. He is the principal advisor to the Vice Chairman and the Member Secretary on matters of technical importance and influences the decisions of the board in matters of policy and forecasting. My interview with him yielded a different response. While he agreed with the Vice Chairman on the issues of the advantages of manual mapping facilities, he complained and regretted that practically no analysis was being done. His primary concern was with the new master plan preparation and that it must become the basis for a computer based analysis process which would generate more in depth research and studies. He said that he would like to move the agency away from its preoccupation with permit tracking to doing more 'queries' and 'what if' analysis which would be possible only using a GIS. To sum up, the Chief Urban Planner did not address the mapping needs issue as separate from the need to acquire a GIS.

It was interesting to note that between the Chief Urban planner and the Vice Chairman, the latter was not interested in changing the functions and activities of the organization, but rather attempting to make the present system more efficient. The former on the other hand was trying to shift the 'nature of the debate' to do more analysis and decision making and was seeing the acquisition of the new technology as a means to foster this new attitude within MMDA. This opinion was confirmed when he said,

> When I was a senior planner in charge of planning permit sanctions, I was more interested in the plain computerization effort, however only as a beginning to the research and analysis effort that I believe the MMDA is neglecting currently. Now that I am in charge of the entire technical decision making, I believe that GIS is a good way to move the agency in the direction of the future (Doss Interview, 1991).

Senior and Deputy Planners

There are two senior planners and about twenty-five deputy planners in MMDA. These interviews synthesize the discussions that I had with eight of them.

The senior planner and the deputy planner in charge of issue of planing permits where not too pleased with the present computerization effort because of its emphasis on keeping track of efficiency of operations on the one hand and actually increasing the paper work on the other. (This complete process was described earlier, in Chapter Five.) They had very little concern about the mapping needs of the agency as their job was so narrowly focussed on the scrutiny and issue of the permits which focussed on individual applications. They spent considerable time in discussing the inaccuracies of the computerized permit tracking system. Ninety percent of the planners interviewed felt that the current basic survey and display of mapped information was satisfactory. According to them, the First Master Plan exercise, if nothing else, had helped to verify and generate a complete set of maps. There are standardized scales in which all maps are drawn. In particular, their discussion of mapping needs was very brief and they moved on to discussing other organizational and technical difficulties that they faced. Clearly their planning problems were not because of poor quality maps.

Draftspersons

The draftspersons were trained to generate and update maps but they were detached from the preparation of the maps to a great extent. Many of them had little understanding about the meaning of the drawing they were preparing. This section comprised of about 200 persons, mostly women. Part of their detachment is that most of them do not go on surveys and site visits and just interpret the encoding made by the field officers. They spend most of their time coloring and shading maps to issue to owners /developers or for discussion purposes at MMDA. During my visit, this section appeared to be not doing very much. I was quickly briefed that it was a slack period because the Master plan preparation was under way.

The draftspersons could not discuss the mapping needs of the agency and they were unconcerned about the entrance of computers into the organization. None of them had bothered to use the digitizer in the computer room. (Incidentally, the digitizer was being used as a table to keep stacks of computer generated print outs.) When I queried about their reactions to the use of computers for mapping, they said that if they were asked to use it and told how to work using it, they would.

6.3 Interview Observations - Potential Impacts of GIS

In this section, I am synthesizing the discussions that I had on the state of the organization as a whole and visions of innovations that would improve the organizations' functioning with respect to its stated goals and the potential impact of a GIS in the present context.

Vice Chairman - MMDA

The V.C. had earlier spoken about his search for an ideal mapping software. He now spoke about the organizational problems that he is faced with in the process of buying a commercial software package. The vendors of the software *ArcInfo*, a popular GIS system, had given an audio visual demonstration where they had shown the use of queries to solve different planning problems.

The Vice Chairman felt that he did not understand the capability of the system very well and was worried that he would acquire something which was expensive and had limited utility to the organization. He also said that he did not see the special advantage that a visual mechanism would have over the existing data base management system. He did not rule out the incorporation of the visual component in the future but felt that there was more work to be done with respect to the transfer of raw data and information collected in the field and its representation and use in maps, and in decision making, before one could move on to a high technology effort.

Chief Urban Planner

The Chief Urban Planner is clearly another champion of the GIS effort. He points out that the value of a visual tool is in the questions that get raised because of the presence or the absence of certain phenomena. The Chief Planner almost directly contradicts the Vice Chairman's vision when he says that the spatial referencing, so key to GIS, is the feature that would generate more accurate and relevant analyses and present innovative solutions to planning problems. Examples that he gave included location of available parcels of government owned land to plan future development,

and conducting suitability analysis for the location of large industrial facilities. This last application was in particular reference to the State proposal to locate a multimillion dollar Aromatic Plant in the new town proposed by MMDA.

In addition, he disapproves of the deployment of outside consultants especially from the United States, most of whom he feels are not sensitive to the problems of the city. Working with techniques they are familiar with will add credibility to the agency's analyses and use of a GIS offers such an opportunity, especially in the agency's dealings with the donors and their representatives. Within the context of the city politics, he feels that the technical decisions would be stronger and it would be more difficult to change them to politically or bureaucratically convenient decisions.

Senior and Deputy Planners

The planners all agreed on three issues that were related to the implementation of the GIS effort:

1] The need for the use of a technology to convince the management (politicians and bureaucrats) of the merits of various planning proposals, a visual and communication tool which would be dynamic in the sense that various changes should be made and the impacts seen instantaneously. This was seen as more effective than the existing mechanism of paper drawn maps.

2] It would facilitate the collection of more accurate and parcel level data and build up a robust data base which would then be used for further analysis.

3] Strong backing is needed from the World Bank to go the GIS way, and the Bank was responsible for pushing MMDA and other agencies to go in for computerization.

Draftspersons

I did not discuss the potential impacts of GIS adoption with the draftspersons, since they did not appear to have any control over its adoption or use in the agency.

Moving from MMDA to the other planning agencies operating within the Madras metropolitan area, I will first discuss the computerization efforts within the Town and Country Planning, Board, a department directly under the State Ministry of Housing and Urban Development. I also looked at other planning agencies which have: 1] operational links with MMDA; and had 2] partially or fully computerized their planning operations. Looking at these other agencies helped me understand the successful manner in which computerization was introduced in these agencies, and provided suggestions for approaches that may be adopted by MMDA if it chooses to introduce a GIS into its organization.

6.4 Town and Country Planning Board

Through the amendment of the 1920 Town and Country Planning Act, this Board came into existence in 1972 and develops plans for the state. It develops plans for the metropolitan and state levels and advises local authorities on the nature of development of their area. It collaborates with many state agencies in data gathering efforts and has an extensive data base of information related to spatial planning. However, it has no implementing power and usually its research findings are ignored.

I interviewed the Director of the organization as well as the personnel who were involved with the mapping and analysis of data. As mentioned earlier, the major task in the agency is the preparation of plans, since the smaller townships and municipalities who do not have planners on their staff rely on this Board to guide their development. The office employs about one hundred people, of whom about sixty persons coordinate the drafting and the administrative responsibilities and the rest are a cadre of planners who conduct analysis and design the layouts and plans. The jurisdiction of the agency extends state wide but excludes the Madras metropolitan area. The agency's formal link to the MMDA is tenuous but the informal networks are very strong and MMDA uses as reference a lot of studies conducted by the Board.

The agency has acquired a thematic mapping package called 'Themaps' developed by a firm in Pune, India. The staff persons at the agency, using this package were able to conduct a series of displays which gave the location of large towns, urban

agglomerations, district boundaries, census information etc. Using a digitizer, they had digitized a paper map of a small village and were testing out the queries that they had developed. The work is being done with the help of private computer consultants. Besides this, the agency uses computers for day to day activities such as word processing, accounting, spread sheet analysis and data base management. They work with the census division to design more standardized data collection procedures to suit the requirements of the various planning agencies. Examples of their work are found in the Appendix.

6.5 The Housing and Urban Development Corporation (HUDCO)

HUDCO, a financial institution set up at the national level, has the organizational capacity in the form of technical,financial, construction, legal, and economic expertise to formulate , implement, and monitor housing and urban development schemes financed by it. The TNHB is one of its biggest borrowers and as part of the monitoring process HUDCO comes into close contact with the MMDA. This agency is focussing presently on appropriate technology and low cost construction techniques to increase the housing stock in the country. It advocates low rise-high density housing in the urban context. It undertakes counselling and guidance on house finance and construction. The HUDCO regional office is located in the MMDA office complex and the scenario is very different from MMDA. The first thing that I noticed was that it was a very small agency, the center employed perhaps thirty to fifty people and the lower end support staff were a minimum compared to MMDA. The Regional Director was a very dynamic personality and had this to say about his agency:

> We have had a computer culture from Day 1. Go and look - you will not find a type writer in our organization, only word processors. Our records are in good shape because of two reasons, the first is that we have worked on setting up our system to be tailored to our needs and we were very clear on what we wanted from our data base management system. The other reason is that our operations are simple, we monitor progress of projects financed by us according to the guidelines that we set, and the reports are expected to be in the format that we request (Suresh Interview, 1991).

Talking about the potential use of GIS, the director and the staff feel that the agency would benefit from a visual analysis of quantitative data because their operations are spread country wide and the regional office requires the simultaneous monitoring of various projects. They are confident that GIS implementation would follow as a natural addition to the present information processing capabilities of the organization. Their reactions to MMDA's computer effort was one of skepticism because it appeared haphazard and unstructured in their eyes. For example, HUDCO's staff complained that whenever MMDA couldn't work something out with their newly acquired computer system, they would stroll into the HUDCO office to seek help to figure out how the system works. HUDCO staff also said that MMDA and other agencies were not good at managing data, especially financial data, and wondered how computerization was going to solve the problem of inaccurate or badly maintained data.

6.6 National Informatics Centre

The National Informatics Centre is a specialized data collecting agency of the federal government. It links the different towns of each state to the state capital and the state capitals to the central government at New Delhi. It operates under the central Ministry of Planning. The agency is responsible for collecting and maintaining a comprehensive data base of planning related information which is needed, typically information about literacy rates, number of schools, number of unemployed persons, number of youth/senior citizens and so on. I talked to this agency about data sharing and they said that they have provided information to MMDA on specific issues. However, this agency though it had an extensive mainframe set up, they were not doing any spatial analysis.

When I asked them what the digitizer and plotter were doing there if not for the purpose intended, they indicated that there is a proposal to do spatial analysis and the hardware had been purchased. There was no organization in the matter of data collection and it appeared that the analysis, if any, was not being done at this center which I visited. The issue of paramount importance here was secrecy, the center was so low profile that not many people knew of its existence or the nature of its activities.

From my interviews with these other agencies and my interviews with individuals involved with decision making in other planning related activities (e.g., rural development planning) a clearer picture seemed to emerge about the role of data and its usage in the Indian planning context. I will analyze these findings in greater detail in the next chapter.

6.7 Computerization - Issues Identified

6.7.1 Which Agencies found it easy to use Computers?

Experience showed that the agencies that had introduced computers into the agency on Day 1 had a head start over the other agencies in the acceptance of computer use by the personnel. The manner in which the computers were introduced was also important. Both HUDCO and the Town and Country Planning Board had not introduced computers for a specific set of planning application but rather had purchased a bunch of personal computers and scattered them around the agency. They wanted to avoid a typical scenario that occurs daily at MMDA. As the Director of the Town and Country Planning Board put it:

> The person equates the computer to the God, the computer room to a temple the computer programmer to the officiating priest and is programmed to act accordingly. He removes his shoes outside the computer room, hands over his requirements for analysis to the programer and waits, sometimes for days for the results to be handed back to him. He has no way of verifying the accuracy of the analysis, he has to 'take it' or 'leave it' (Chandrashekar Interview, 1991).

This reference is to the sequence of events occurring at a Hindu temple. As amusing as this may sound, it is what happens at MMDA. The physical isolation of the computers and the aura that surrounds their use creates an environment which restricts computer use. Also programmers' and analysts' words are taken to be accurate and the planners do not grasp the opportunity to understand the technology. If this trend continues, computers will have limited use in the organization and the organization will move into its usual state of equilibrium as it was before the introduction of computers.

6.7.2 Problems frequently mentioned at all agencies.

The conflicts between trying to use commercially developed software versus the use of specialized software was a point of discussion in all the agencies. Most agencies said that the software vendors in India had rudimentary knowledge of the system and could not offer support after purchase of the system. Power failure was cited as an important criteria which hampered efficient computer operations. The necessity or the perceived necessity to keep the computers in a dust free environment required that they be in air conditioned rooms making them inaccessible. The speed at which the software got upgraded was too much to keep pace with.

6.7.3 Problems Specific to MMDA

In MMDA, the problem was that the planning tasks were very varied and it was the largest organization among those compared. While the scale by itself created problems of management, and the fact that the agency was not introduced to computers on a day to day basis was a separate problem and the Division of Computerization was having a difficult time in trying to motivate people to learn and use computers. Further discussion and analysis of this issue follows in Chapters Seven and Eight.

6.8 Organizational Issues

6.8.1 GIS - A Prospective Solution

As a senior bureaucrat put it, "Systematic gathering of information with an intent to analyze it is not evident in the state. The collection, updating and manual retrieval systems are failing and cannot keep pace with the complex problems of rapidly urbanizing areas. In this context, *something* is needed to motivate the change. That is the role that GIS is going to play.."

> As administrators, we have to know the situation, to decide what is uncontrollable, what is solvable. Day to day decision making will be made easier by using some form of GIS. If I have visual knowledge

> about various sectors of the urban conglomerate, I would certainly be in a position to design and implement a meaningful intervention (Narayanan Interview, 1991).

6.8.2 Why GIS?

> What is the use of an analytic tool when the decisions are not made using the analysis? GIS or no GIS, the process is so politicized that it would not make a difference? (Anonymous Interview, 1991).

I did get this response from one or two persons, but I did feel that their analysis was very shallow. They discounted the fact that, while by the nature of representative government some decisions are political, day to day administration was not. Complaining that the decision making was political and stopping from moving on seemed a way to maintain the status quo and shift blame on to the elected officials and administrators. Fortunately this was a minority opinion, but indicated that care must be taken to involve all representatives before establishing a GIS in MMDA.

From my interviews, I have found that MMDA has the infrastructure necessary to start a GIS effort. In the next chapter, I will discuss the potentials and constraints that will impact the GIS implementation effort.

Chapter 7

A SUSTAINABLE GIS FOR MMDA

In the preceding chapters, we have progressed from understanding the context of the region, Tamil Nadu, the city, Madras, the metropolitan area, MMA, the various agencies operating within the region and the role of the Madras Metropolitan Development Authority, MMDA. In addition, we have also learned the MMDA has introduced computers into the organization, is interested in the capabilities of GIS and is a potential GIS user.

In order to address my research question "What are the potential benefits and constraints to GIS being adopted to metropolitan planning agencies in developing countries," I intend to spell out the reasons that I think will facilitate the adoption of the technology and highlight some of the problems in achieving these objectives. The process of adopting the system, its capabilities, and the functions that it can be used for are important in sustaining the GIS effort.

I will first discuss the nine potentials that will foster GIS adoption in the agency and then go on to discussing the five constraints that are likely to impede its adoption.

7.1. Potentials

7.1.1 Computer Culture

It is generally very difficult to introduce a GIS where there is no understanding of the basic concepts about computers. During my interviews, I found that most of the staff persons, especially those who were at the lower end of the organization's hierarchy, were trained in the use of software for word processing and spread sheet analysis. This is because in the competitive job market, computer skills are generally seen as an asset. Most people learn to use a couple of P.C. based programs that are

perceived to be most useful. Based on my interviews, these programs were Word Star and Lotus 123, and more advanced users had learned to use dBase 3 +. MMDA, on the other hand, is encouraging personnel to sharpen up their computer skills by providing incentives in the form of paid time to learn these skills and permission to work on the machines in the office.

However, the computer set up now in place, because of the implementation of the present computerization efforts have paved the way for the next stage of the process which is to introduce some kind of spatial mapping package

7.1.2 Accessibility of Hardware and Software

India has an exhaustive inventory of computer hardware and software. There were indigenous computer manufacturers marketing computers compatible with international standards and internationally accepted software was available. The development of local computer manufacturers and software developers has grown because of India's commitment to computerization and technology development as part of its Eighth Five Year Plan (Eighth Plan Document, 1990). To illustrate the point with more specificity, MMDA had acquired about twenty personal computers, a digitizer and a plotter. At every agency that I visited in Madras which used computers, latest versions of the software were available and being used. With all this ground work being laid, I feel that it is easy to develop a computer culture within MMDA which is tuned to using GIS. However, the agency would have to undertake the training of its personnel so as to ensure that the skills acquired are compatible to its needs.

The vendors of the software packages are actively canvassing to promote their products. In Madras, the commercial package *pc/arcInfo* was being widely marketed. The product's local dealer had given a demonstration of the capabilities of the system to the senior officers of MMDA. The planning agencies that had interaction with MMDA were all familiar with the concepts of Geographic Information Systems. This is an asset to to easy acceptance of GIS within the organization.

7.1.3 Personnel Trained in GIS Concepts

MMDA has about twenty-five deputy planners. They are dispersed among different divisions within the agency and hold supervisory capacities. Most of these planners have been sent for advanced training in the West, for example, the then senior planner who is currently the Chief Urban Planner, was a SPURS fellow at Massachusetts Institute of Technology in 1984 -85. Most of the others have received training in different British Universities and one of them had visited the Netherlands. These training programs were usually for short durations extending from six to twelve weeks and in some cases had been extended for a year.

As a result of international exposure to different planning concepts and techniques, these planers had a general awareness of the capabilities of a GIS. They had showed their experience when they had recommended that MMDA not purchase an architectural drafting package, (Autocad version 10) as they did not see any use for it in the organization. In particular, the Vice Chairman showed a good understanding of he subject when he said that he was looking for a dynamic programming tool which would help him figure out least cost solutions and some efficient solutions which he did not find in the commercial software. He also commented on the fact that most of it is written for the West and sometimes is irrelevant in the developing country context. This level of understanding is important to help decide on the appropriate technology to suit the needs of the agency.

7.1.4 Champions of the GIS Effort

Establishment of a GIS cannot take place without a supporter within the agency (Croswell, 1989). In MMDA, there is a champion of the GIS cause - the Chief Urban Planner. We have learned (Figure 3) that the Chief Urban planer makes the technical decisions within the agency and is responsible for all the units functioning in MMDA. There are two chief Urban Planners at present in MMDA. However, one of them is due to retire shortly and wants to have nothing to do with the computerization or modernization process and is adopting a policy of non-interference. Thus, the other Chief Planner has found it easy to push for the changes that he would like to see made.

He told me that the computerization process started when he was the Senior Planner in charge of Planning Permission Sanctions. He says that " the computerization effort as it has been set up is allright to begin with but I want to do more research and analysis" (Doss Interview, 1991)." He hopes that the successful establishment of the computerization process will help him push the GIS effort a long way. He believes that MMDA must have a vision and must move away from the routine tasks that it performs currently to study innovative solutions for planning problems.

The other champion of the computerization effort and a potential supporter of the installation of the GIS is the current Vice Chairman. He is a firm believer in the use of "technology" to make the lives of his personnel easier and his organization more productive. He expects that the organization can contribute a lot to the development of the city, more than it has been doing in the past and looks forward to using a system which can speed up the mundane tasks like permit sanctioning which would give is planners time to work on more complicated problems and to come up with answers to manage issues of urban migration, zoning and land use planning in a more efficient manner.

> I hope a time will come when submitted plan applications can be scanned into the computer, be verified to a given set of constraints, for example side and front open spaces, minimum dimensions of rooms and openings, height conformity all to to code requirements and the variations from the standard recorded so as the planner can make a decision whether to allow this small discrepancy through an exemption or to reject outright. If it is an ambiguous case,then the current process will fall into place with the decision making passing on to the next senior position on the hierarchy. In this situation, if the plans are 'correct' the decisions can be made immediately and passed on to the owner/developer. Am I expecting too much from the technology? Are such capabilities available? (Subramani Interview, January 1991)

These are the people who will sustain a GIS effort and are in a position to convince and move the others in the agency towards using the system.

7.1.5 Young Enthusiastic Organization/ Personnel.

MMDA was created in 1972 and at the time drew most of its senior staff from other agencies who either took leave from these organizations or were recruited from the parent organizations to serve in MMDA. Eventually, these positions were formally regularized and State government pay scales and benefits were given to these people. Over the years, the personnel joining MMDA have been younger, more enthusiastic folks from different parts of the state and from other parts of India. The agency is small enough for people to identify with its development and are interested in being a part of its progress and in its growth see room for their self development.

Many of the planners I met at MMDA evinced keen interest in the overall development of the agency. They see the introduction of Information Systems in general, and GIS in particular, as a part of this developmental effort. One such example of enthusiasm is highlighted here. In addition to showing the interest and competitive spirit that the agency has, it also gives a hint of the kind of queries that could be raised as part of the analysis. The senior planner in charge of computerization gave a current example to emphasize the urgency of acquiring a GIS. Recently, the state government decided to auction the rights to operate liquor stores within the city. The profits were expected to replenish the state's empty coffers and there were a large number of bidders. The sites were prospective bidders could be allowed to locate their stores had to govern careful consideration. This is because in accordance to the current prevailing religious and social trends of the country, these stores were to be located at least half a kilometer away from places of worship and schools and other institutions. However,to generate revenue, these stores needed high visibility and accessibility.

The government department coordinating this process sent a query to MMDA and other agencies about the matter, specifically requesting them to identify sites on public highways, which were conformed to the constraint of distance from schools, hospitals and places of worship. While the MMDA could give help to potential bidders on a case by case basis, the Department of Town and Country Planning gave a visual display of such locations in relation to their spatial location for selected areas.

The chief minister was very pleased with the work of the other department and the officer at MMDA felt that such a query from the government could be effectively dealt with if they had used a mapping and analysis tool.

7.1.6 Number of Personnel deployed in Mapping

The core of MMDA's staff is comprised of about two hundred and fifty architectural assistants and draftspersons. Most of them were hired, as explained in Chapter Three, during the preparation of the First Master Plan. They are concentrated in three areas, namely; 1] the Master Plans Unit involved in the preparation of the Master Plan and subsequently involved with incorporating changes in the land use based on the surveys and inspections carried out by the MMDA staff, 2] the Area Plans Division within the Master Plan Unit where the task is the scrutiny of planning applications for conformity with the MMDA's Development Control Rules, and 3] the Area Development Unit which works on the design and detailed layouts of the new towns intended to reduce the congestion within Madras city. The latest project on the drawing boards is the New Town at Manali which is an industrial area in the north of the city. In addition, there are about fifty planners, i.e., assistant planners and deputy planners. The other large chunk of the agency's staff is comprised of the administrative and support staff who manage the planning permissions and the audits and accounts process. Thus there are enough personnel who could be trained to sustain the GIS effort, especially the initial stages which require a large manpower deployment.

7.1.7 Good Manual Mapping Facilities.

Traditionally, Madras has had good mapping facilities! The culture that started in 1834 with the establishment of the Government Survey School in Madras has continued. (Muthiah, 1987). Currently MMDA has good base maps which have a great detail, parcel level, within the city area and revenue unit level outside the city boundaries. Since the preparation of the Second Master Plan is under way all maps are being updated and hence will be fairly accurate. Illegal developments have been separately documented within the city through a census of slums and squatter

settlements and though they will not be very accurate this is a good reference point to do further documentation and analysis. The availability of updated maps will go a long way in helping the GIS effort to get under way at an early date.

7.1.8 Financial Benefits

MMDA will be able to generate revenues through improving its consultancy services. With such a large trained staff, and having the framework to be an umbrella agency, the consultancy role falls neatly into the MMDA's long range plans. Consultancy studies for smaller agencies, and towns who do not have the access to the technology in return for data transfer could be arranged.

7.1.9 Proposed Center for Urban Management

One of the leading technical universities in the area has already set up a Center for Remote Sensing which is doing extensive work in collaboration with national and state agencies. A plan to set up a Center for Urban Management is under way which would involve university, community and public and private institutions to participate in a group endeavor to analyze the problems of the metropolitan area and find cost effective solutions. The GIS effort in MMDA will be strengthened by involving itself with these people.

7.2. Constraints

Having highlighted the potential advantages that could make the GIS implementation effort a successful one, my discussion will be incomplete if I do not address the constraints that might impede the process. The constraints that were observed in developed countries, (Croswell, 1990), turned out be prevalent in my case study. Some examples include data and software standards and data integration were common issues of concern, as were resistance to change. Some other issues like uninterrupted power supply were unique to the case that I studied.

7.2.1 Technical Understanding of GIS

As I had mentioned earlier, there is a general understanding of the concepts of GIS among the senior planners and the decision makers within MMDA. However, the level of understanding is rudimentary and while they state that they will use GIS for analysis, they are unclear as to what kinds of analysis they would conduct. Even as they state that they would conduct analysis, there is disagreement on the nature and level of analysis. However there is unanimous agreement that any analysis that they are currently conduct will greatly benefit from the capabilities of a graphic or visual display of information. For example, the current permit tracking data base helps them identify piece meal where development permission applications are coming from but they would like to see on a map where these are located to see if there could be a pattern that is emerging which would help them observe and guide the nature of the development. This observation would also help them with the modification of the development control rules and byelaws.

The staff of MMDA have to clarify in their mind what it is they need to understand and analyze, and the establishment of the GIS effort will also help them to think about these issues in a more focussed and immediate manner. There is a danger of both the Champions expecting more than a current GIS can deliver. The coordinator of the GIS effort will play an important role in helping the personnel of MMDA define and elaborate on the exact nature and scope of their analysis.

7.2.2 Quality of the data

In my opinion, MMDA and the other agencies have an immense amount of data that they are collecting, but it is not standardized and thus is not put into any use. The data is not used for any analysis and there is no mechanism to store and retrieve it and use it for analysis and therefore for decision making. The rules of thumb that have been developed are those that planners and decision makers rely on. The use of data is more to justify a particular decision, once made based on other criteria such as political expediency or resource constraints. For example, the Department of Statistics specializes in the assembly and manipulation of data which is tailored to case specifics.

It appears that better data collection will not lead to better decision making because the agencies are not using the data for decision making now. In this context, highly detailed analysis is not possible in the near future and any effort that is made to assemble an accurate and very sophisticated data base at first is doomed to fail. This is a serious constraint to GIS implementation.

7.2.3 Updating of current data

While the amount of data being generated by the government agencies in India generally, and MMDA in particular, is incredible, the data collection is usually a one time effort. As a result the data at any given point is partially outdated, thus seriously affecting any analysis depending on the nature of the of the subject being studied. Some of the data the MMDA has on land use, for example, is hopelessly outdated. The land they classified as a agricultural has been built up many years ago! However, in the course of the preparation of the Second Master Plan, a more reliable data base is being built up and this will ensure a better base to begin with. However it is a problem that might slow down or render impractical any analytical capability that is made possible through a GIS.

7.2.4 Project driven GIS Effort

The GIS effort is usually project driven (Klosterman, 1990). This feature holds true in MMDA as well. MMDA would like to see results as soon as possible. For the kind of spectacular results that the Senior Planner is envisaging, the work required is a major effort and will not be accomplished through a pilot project. Thus energy is required to sustain the GIS effort beyond the pilot project stage and make it a practical and usable tool for the organization. However, the revenue needed for this purpose cannot be obtained from any funding agency but rather from the nature of the research undertaken. Ideally, the largest beneficiaries from the use of the GIS should fund it. Identification of such a beneficiary is important and without this a GIS is not likely to be successful.

7.2.5 Costs of Establishing a GIS

One of the biggest hurdles in establishing a GIS is the availability of resources. Clearly, MMDA cannot afford a GIS on its own budget. It will have to receive a large grant from the funding agency to acquire the system. Even if this is possible, a solution to provide the maintenance costs must be found so that the GIS is sustained after the grant or funded project ends.

7.2.6 Project Commitment

Montgomery (1990) highlights insufficient project commitment and the casual attitude of the participants in the GIS effort as constraints which are likely to affect MMDA as well. Klosterman (1990) and Croswell (1989) mention the key role played by the GIS manager in ensuring a successful effort. This is a concern in MMDA as well. Since the chief decision makers are transferred to other positions every three years, the continuity of the GIS effort will be lost if the policies and focus of the organization change.
This will affect the initiative and if there is no encouragement at the senior level, the newly generated interest among the staff will fade and die.

7.2.7 Potential Loss of Employment

After the initial effort of digitizing paper maps to store them in computer readable form, the number of draftspersons required will be drastically reduced. A large number of functions, particularly updating of maps and records, could be handled by one or two persons. The organization cannot lay off people as it is a state undertaking but will not create more jobs. This concept may be politically infeasible and thus the entire GIS effort could be abandoned.

7.2.7 Practical Problems

Power failure is a common problem in developing countries and Madras is no exception. The computer system has to have an uninterrupted power supply. In

addition, computer manufacturers in India insist on the provision a dust free environment for their machines. These specifications contribute to the hidden costs that come with the acquisition of a GIS. In their anxiety to create a suitable physical environment, the decision makers forget the organizational problems of physically centralizing computer operations (Chapter 6).

Having analyzed the potential benefits and constraints to the implementation of a GIS within MMDA, I can now move to conclusions about the usefulness of the technology to the residents of the city and the agency and recommend the directions and approaches that the agency could take to establish a GIS. I will also discuss the issues that I consider appropriate for future research.

Chapter 8

LOOKING TOWARDS THE FUTURE

In Chapter Seven, I looked in detail at my main research question and discussed the potential benefits and constraints to the introduction of GIS into a typical metropolitan planning agency in a developing country as exemplified by MMDA. I will now discuss the usefulness of the technology for MMDA and the people of Madras in this final chapter of my thesis.

In this chapter, I outline the factors that will contribute to the development of a successful GIS, I return to Huxhold's (1990) model of the urban information pyramid to frame my discussion about the usefulness of the proposed GIS implementation efforts to the agency. Finally, I present a set of my recommendations which might form one successful GIS implementation path in MMDA. I conclude this chapter by presenting three directions for future research.

8.1 Factors which contribute to the development of a successful GIS

Any plan to develop a successful GIS should take the following seven factors into consideration, regardless of the pathway of GIS implementation chosen. The following discussion is case specific to MMDA but I believe that it is possible to make these factors relevant to similar situations in developed as well as developing countries.

8.1.1 Clarity in definition of problems

All the planners that I interviewed within MMDA profess to having a clear understanding of the practical problems that are affecting the Madras Metropolitan Area. They have difficulty in coming to a consensus about what the MMDA as an agency can do about them. Based on my research, I think that MMDA deals with

finding solutions to metropolitan problems on two levels. On the one hand, the agency seeks better techniques and tools to analyze complex problems and on the other it searches for effective mechanisms (e.g., legal power) to help implement the solutions it has developed. For the most part, it appeared that the vision that MMDA had when it prepared the first Master Plan, and continues to have at present, has not been taken seriously by the state or federal government. Part of the reason for these governments failing to do so is because the agency appears to be functioning as an arm of the state government with a predominantly appointed board and cannot be considered truly representative (Sivaramakrishnan, 1986).

The MMDA has to be more precise in defining its role based on a review of their present functions and activities. For example, if it is focussing on spatial planning issues, it must take into account all the mechanisms that are required to enforce the stated development guidelines. I have distinguished between the larger issue of definition of the problems, and the classic user needs assessment that precedes adoption of GIS, because the users, in this case the staff persons of MMDA, will not be able to identify their real needs without a more specific identification of the problems. The decision makers of MMDA have to decide on both a long and short term strategy, and define the roles of the personnel and the agency more fully before they can benefit from a user needs assessment for GIS.

8.1.2 User Needs Assessment

The user needs assessment for the present computerization effort that MMDA has established was not conducted properly, resulting in an underestimation of the data requirements and computing needs of different divisions (Anonymous Interview, 1991). This may be partially true, in that there was too little consideration of the use of computing for analysis and its effectiveness in decision making, and this has resulted in computers being used only for automation of routine tasks.

The GIS development and implementation should be established only after a more definitive user needs assessment . The assessment should be done by an agency or a consultant familiar with the working of the agency. The previous assessment was

done by a systems analyst from a consulting firm which appeared to be indebted to the Vice Chairman for getting the project in the first place. Through my discussions, it appeared that the agency had conducted the needs assessment in a slightly superficial manner. They had talked to some planners but the general impression that 90 percent of my interviewees had about the assessment was that it was perfunctory, did not ask or seek real answers, and was done mainly to 'tell' the planners about the computer system that MMDA was about to acquire.

I think that it is essential that a computer literate planner who knows GIS do the user needs assessment. From my understanding, it appears that the use of data for decision making occurs as well defined and specific functions. For example, data is used in both the planning permit sanction procedures and the development of the Master Plan, the first and third levels of Huxhold's pyramid of tasks (Huxhold, 1991).

The quality of the data and the aggregation level varies vastly, to build a GIS. i.e., permit tracking requires accurate parcel level data which becomes inadequate if not updated in a reasonable time frame, (development occurs rapidly and a lot of conversions of old houses to modern apartments is taking place) whereas the Master Plan development requires information looks at broader land use patterns and does not require accuracy. master Plan efforts are 'snap shot' analyses which are not useful if not updated, however, the updating is not required with the urgency of the first case.

8.1.3 Inter-Agency Coordination

Coordination is perhaps the weakest link in MMDA's activities. Despite the presence of institutional mechanisms to achieve coordination, it often doesn't occur. However, the GIS effort will be doomed to fail if there is no coordination among agencies. The heads of these agencies need to discuss the possibility of data sharing in order to meet their different needs so that they can all help each other use the limited resources.

It is not possible to install a GIS in each agency, nor is it the answer. MMDA is in a position to contribute information such as number of residential planning permits

sanctioned to a particular block or census division, or the number of illegal developments they recorded while doing their land use surveys as well as in a position to benefit from receiving information from other agencies and it has the ability to design and establish a coordinating mechanism.

It is possible that the institutional framework developed to sustain a regional effort will benefit the State of Tamil Nadu as a whole and help set standards for mapping, data definition and collection. A coordinating committee should be responsible for setting up the coordination of the GIS effort in different agencies in the metropolitan region. Such an effort could start with the metropolis as part of the MMDA but move to become a separate entity, and exist as a separate institution. The Tamil Nadu Housing Board and the Tamil Nadu Slum Clearance Board, though state agencies, are not likely to lead the coordination effort because of the narrow scope of their institutional activities.

I have found that the Town and Country Planning Board is the most interested in and organized about their data collection and management. Although they have had a regional focus, they have used their expertise in collaboration with other research groups to study the problems in the metropolitan area. The agency has close links with the MMDA because some of the senior planners of MMDA were drawn from this agency. There is no competition between them or issues of turf because they have different jurisdictions. In the light of the above mentioned factors, I believe that the Town and Country Planning Board will be the ideal agency to carry out the coordination of the GIS process, in close conjunction with MMDA, in particular the parts dealing with setting standards for data collection and the design and maintenance of the data base.

8.1.4 Personnel Training

At the time I conducted my interviews, the Senior Planner, Division of Computerization and also in charge of Project Evaluation and Training, was complaining about the lack of interest in the incentives offered to the staff of MMDA. My analysis of the lack of interest is that the staff do not see the computer training as

being beneficial immediately in their work environment. For example, there are two hundred persons employed as draftspersons who hold diplomas in architectural and civil drafting. They are unsure of what to learn and about what would be useful for them. For example, should they learn to use an drafting package or a data base management package? Coupled with this dilemma, there is a disincentive operating subtly, since officers or staff having computer skills are not given any special recognition for their work in terms of benefits or promotions in the organizational hierarchy.

I also feel that the training programs will kick off more efficiently if they are geared to the immediate needs of the staff persons of MMDA and if clear direction is given on the type of knowledge they should acquire. If they are going to spend a large part of their time digitizing maps, then there is need for them to learn that skill so that precision and accuracy in mapping can be achieved.

From my field visit I have concluded that GIS is more easily implemented if all the contributors to the GIS implementation see some benefit in it for their work in the agency. This will directly contribute to make it a successful implementation effort. For example, the planning permit processors in MMDA should see a benefit for themselves in keeping the data base current. If they get information from this process that helps them do their other planning/administrative tasks better, that by itself provides an incentive to update the data on a fixed schedule.

8.1.5 Collection and Management of Data

The ultimate value of a GIS lies in its unparalleled ability to store, manipulate, integrate, and display geographically-referenced data (Yeung et.al., 1989). Thus the collection of the data and its management has to be well specified and carefully organized to suit the system design. MMDA collects and manages most of the data it requires for its planning applications (Kumar Interview, 1991). It will therefore be easy for them to integrate and make the collection consistent with the system's requirements.

However, the industrialized world's experience reveals that the construction of the data base is the largest expenditure in implementing a GIS (Worrall 1989). MMDA and other planning agencies in developing countries should undertake the data base design with the vision of a fairly accurate parcel based GIS for the whole metropolitan area in mind, but may undertake it using an incremental development strategy. The intent should not be to acquire all the data during one phase of the project, but the system developers should recognize that the kind of data required for the purpose a variety of the desired analysis should be clearly understood so that it will be easy to add additional information to the data base as it becomes available.

8.1.6 Incremental System Development

Resource and data constraints will force MMDA and other such organizations in developing countries to adopt an incremental approach to system development. This assured, my concern is that the different phases that the system has to go through before attaining its full capacity are linked by a common thread and long term plan. In addition, the initial interest generated should be sustained so that the momentum does not slow down and bring the GIS initiative to a halt. For example, the Tamil Nadu Housing Board introduced computers into their agency about six years ago and, at present, the system is not used. The organization has moved back to doing things "the old way" (Rotner Interview, 1990).

Therefore, the first step towards introducing GIS is a crucial step because the expectations of different people within the agency - decision makers, planners, administrative staff and draftspersons - are varied and must be coordinated with a long term strategy in mind. Likewise, there is a lot of demand for a visible "product" like a map or analysis and the time taken for that to occur has to be made clear at the initial stages.

8.1.7 Role of Advocates within the Organization

In addition to the senior decision makers who are responsible for introducing the GIS effort, the strongest advocates are the middle level planners who are likely to

remain in the agency the longest. For example, in MMDA, the senior and deputy planners are convinced that GIS will make their work more productive and interesting.

> Our future is here, we get a lot of benefits from this job,housing loans for one. The job -its permanent; we have no real interest to look for other jobs unless something spectacular comes up. We are sent abroad, to U.K, to U.S.A .... to get training in the newest planning techniques! (Anonymous Deputy Planner Interview, 1991).

This quote from a deputy planner is interesting because, on the one hand, these are the people who may not be too interested in new innovations but on the other hand, they are there to stay for a long time and must be considered as potential allies required to sustain any new implementation effort. Unlike the private sector, there is less of a concern about the fact that after the GIS skills are acquired, the individual will move on to find a better job. This is an issue that will be of organizational importance and has to be studied by the person who implements the system as the situation may vary widely between different cases.

My conclusions about these practical aspects of GIS implementation and the manner in which they affect organizations have been drawn from my discussions and interviews at Madras. I have drawn more general conclusions from the Madras case which serves as a reference point for my discussion. There are many routes to successful implementation. I have said earlier that the GIS can be designed only if they can understand what they need and what they want it to do. As part of my recommendations, in this next section, I describe two scenarios that I envision for the future of MMDA and then use those examples to define the nature of the system required to be developed.

8.2.1 Benefits to the Residents of the Metropolitan Area

First, the process of applying for planning permission becomes more 'user friendly'. This is likely to be translated into increased public commitment to honor the letter and spirit of MMDA's rules. The public no longer have to be 'licensed surveyors' or have special technical skills to find out what kind of building and land use is compatible according to the guidelines provided by the MMDA.

People are under the impression, perhaps rightly so, that the planning permit process is long and tedious and that it is too complex for their understanding. This feeling puts them at the mercy of many illegal operators within and outside the system who promise quick results for monetary considerations depending on the complexity of the proposed development. People also have a tendency to avoid going through the formal channels of application because they fear delay and harassment (Anonymous Interview, 1991) from the MMDA staff. Right now the planning permit sanctioning process appears to be frightfully arbitrary. The fact that the members of the public will be able to see the nature of the development controls and understand it more clearly will encourage them to work within the system, especially if the various schemes currently being considered by MMDA for implementation, e.g., incentive zoning, come through.

Second, the use of interactive communication tools may empower the potential buyer of properties in the Madras Metropolitan Area. Potential buyers could now make decisions on investments of land for housing or for constructed housing with more clear information on the intricate details of title, development permission and conformity with the MMDA rules. No longer would a member of the public have to believe verbatim the misinformation often put out by various 'middlemen' who negotiate the sale of properties or the publicity brochures of developers alone. This point is verified because "MMDA approved" plots or built apartments are very often priced higher than the current market rate (Anand Interview, 1990).

In order to help the public who faced many hardships due to the false claims of developers and sellers, the MMDA set up the consultancy center in 1987 and continues to offer to verify the records connected to the concerned property which may impact potential buyers. This service has been restricted to answering queries made in person and usually is a slow process. Since the personnel in charge of the consultancy counters are not familiar with the development outside the city boundary, queries relating to development of areas outside the present city limits take much longer than usual, very often involving a two week waiting period at a minimum.

The delay, and the insistence on a personal inquiry, puts residents on the outskirts of the metropolitan area at a disadvantage and at present they often do not get the benefits of MMDA's counselling process.

8.2.2 Benefits to the Agency

The manner of the publics' interaction with the MMDA might change dramatically and its public image as a large bureaucracy might become one of a more personalized service agency. "MMDA is not a line agency", says the Vice Chairman of MMDA. However, as far as permit tracking goes, MMDA is functioning like a line agency and has taken on the task of regulating and monitoring development. From my interviews I have found that the MMDA staff are very concerned about the efficiency of their permit tracking process since it is a determinant of the agency's reputation (Tripathy Interview, 1991). The entire computerization effort that has thus far been carried out is largely a public relations effort (Subramani Interview, 1991).

I do not see MMDA getting out of the planning permit sanctioning business for a while, and I believe that MMDA should continue its present computerization efforts through the acquisition of a GIS . This can be useful in operations, management and policy (Huxhold, 1990).

Operations

Applying GIS capabilities to the permit tracking process, and by using it to handle public relations more efficiently, frees up planners and resources to deal with more acute planning problems. It also keeps track of the development visually to give a sense of the nature, magnitude and directions of the development, and this information should be useful to help modify MMDA's longer-range planning approaches. I am not recommending that the process be automated to the extent that the user does not have to communicate with the planner in charge at all.

The level of automation that I am recommending is a procedure to isolate the basic or standard queries and handle them through the GIS, so that the time of the

planners at all decision making levels is not taken up by meeting with members of the public who have queries about their particular parcel or development within the Madras Metropolitan Area.

Management

The MMDA presently functions as a regulatory agency and one of the functions it performs is on site inspections to ensure conformity with its rules. It needs to distribute the workload between its staff in this division who often complain of overwork (Doss Interview, 1991). In addition, the demolition notices and action in connection with them can be coordinated if a GIS is used to link up with their data base. This visual mapping would be the beginning of the analysis which would help the planners see patterns in the violations, (for example whether violations are being committed by the same architect/developer or whether many are in the same neighborhood). Using GIS for management for their day to day tasks would also help to set the policy agenda.

As I mentioned in Chapter 6, the senior planners that I interviewed said that they saw GIS as a medium to convince decision makers at the state , national and the international level of the validity of their concepts, and as an aid to help them present more convincing arguments about the efficacy of their planning interventions. As MMDA aspires to be "innovative" in its intervention strategies, they will continue to move away from traditional techniques of land use planning towards systems of using incentives to direct the nature of development, rather than coercion alone. GIS will help the planners explain their concepts better to the decision makers, thus serving its function as a management tool.

If MMDA is able to get its system up and running then it can persuade other agencies to adopt the standards it has defined, participate in the data gathering, and become part of a data sharing effort. Preliminary meetings to establish a GIS should undertake this coordination exercise and create a path for a linked system development with other agencies, in particular, with the Town and Country Planning

Board. Right now, this will be the long range effort which should involve a complete user needs assessment and comparison with other agency's needs.

Policy

MMDA is currently working on the Second Master Plan effort, and is attempting to correct the deficiencies of the First Master Plan which gave undue importance to spatial planning alone (Subramani Interview, 1991). They plan to address metropolitan problems which are not directly related to spatial planning, including problems of unemployment , the nature of the metropolitan economy, identification of sectors in which jobs can be generated, and analysis of impacts of migration on the economy. In addition, as part of the spatial planning component, they address techniques to augment housing stock, plans as to where to locate such housing and on the creation of a New Town in the periphery of the metropolitan area.

Situation 2

1993! The Chief Planner is annoyed. He has just returned from a meeting with the Director of the Industries department . The director had informed him that the new licenses that their department was granting was located in Minjur, a small town within the MMA. The proposed industry was a tannery which has the potential of discharging harmful effluents into the surrounding areas, especially contaminating ground water sources. The Chief Planner is worried because, the Minjur is one of the areas which has excellent ground water sources and is one of the points where ground water sources get recharged. He is aware that the Industries department is a more powerful and independent body. His only way of stopping this proposal is to make a direct appeal to the Chief Minister (CM) about the long range implications of this development. He needs to explain to the CM the situation , but will get at the most ten or fifteen minutes to make his case.

To make the strongest impact, he decides to make a visual presentation. He calls up a map showing land use coverages which indicates that Minjur is still predominantly an agricultural/residential area. Another map coverage displays water

resources of the region. Yet another map indicates nature of the soil type. Another map of historic data displays a traditional monument in the region. Using this tool and information gathered from different sources, the Chief Planer makes his case that the new tannery should not be located in Minjur and requests that the Industries department comply with MMDA guidelines. The CM is very pleased and interested in the possibilities of this new technology. the image of MMDA goes up a notch.

8.3 Recommended pathway for GIS Implementation

I believe that their present research and analysis would be greatly enhanced if they used a GIS which would help them map, on different layers, information gathered from different sources, (e.g., demographics from census data and location and extent of agricultural land from the Department of Agriculture). Metropolitan level analysis would be possible, especially the generation of "what if" kinds of analysis which will contribute to the generation of different scenarios for objective decision making. From the above discussions, it is clear that there are two different requirements emerging due to the complex nature of MMDA's operations which form two phases of MMDA's GIS implementation plan.

In order to fulfill its goal as a metropolitan planning agency, implementing the goals statement laid out in Chapter Three of this thesis, MMDA should use a GIS which can analyze information at an aggregated level. I recommend that the level of aggregation is at the village or town level for the area outside the city limits. There are about three hundred and ten villages/small towns within the metropolitan area. survey number wise land use data is available for each village and town and is available with the offices of that village/town. this will be the practical level of aggregation.

The city area according to the MMDA is made up of hundred planning units, each planning unit made up of ten blocks. These blocks are consistent with the revenue divisions. The City Corporation divides the city into 150 divisions through which it provides services, each division being a certain number of blocks. Since there

is a difference in the planning units of the MMDA and the Madras Corporation, the common unit of analysis becomes the revenue block.

There are 5000 survey numbers in each planning unit and there are about 5 lakh survey numbers in the city by a conservative estimate (1 lakh = 100,000). Survey number wise land use data is required and is available for planning purposes but is too cumbersome to maintain, hence I recommend that it is used, aggregated at the block level. As the individual villages and towns develop, the data can be differently aggregated by block level as in the city area.

2] In the next phase, MMDA can work to enhance the planning permit tracking capabilities that it has by mapping a parcel level data base for the metropolitan region which will aspire for an accuracy of ± 2 feet. The situations concerning permit tracking will work only of it possible to locate your own parcel for development and get accurate information about it. This seems to be impossible at the present time, even in the near future because of the number of parcels that are required to be mapped.

Therefore, the attribute parcel/survey number data base that has been developed must be updated and maintained by MMDA. No spatial component need be added now. If there is a major project, for example the creation of a new town or the redevelopment of the central business district which are large scale resource intensive efforts, then at the time, the new proposals can be digitized at the parcel level to build up the spatial component of parcel level data base.

Simultaneously, the following three tasks have to be accomplished.

- A GIS manager has to be hired for the project. He or she should have the status of Chief urban Planner to facilitate the coordination efforts.
- the user needs assessment for GIS should be conducted and must be goal oriented and must be project specific.
- The champions of the GIS cause have to be educated not to over expect quick results and over commit potential capabilities.

During my field research, the agency had no particular goal which required GIS use. Hence, I have developed the following assumptions which will then define the sequence of work that must be undertaken.

8.3.1 Assumptions made

My recommendation for the actual implementation process within MMDA is based on the following set of assumptions which have been guided by my personal observations of the trends of growth in the metropolitan region over the past decade and through a synthesis of the interview data collected in 1991.

1] The metropolitan area outside the city core will develop more rapidly in the 1990's. This will a direct result of MMDA's policy to reduce congestion the city area.

2] Development within the city will be predominantly residential, particularly, it will take the form of reconstruction within the same parcels, i.e., apartment complexes on plots which were single family houses.

3] Costs of digitizing maps, particularly creating a base map would be comparatively low (I estimate about $ 2 per parcel) because of the lower costs of labor and availability of a large number of draftspersons within the agency.

4] The MMDA will continue to undertake permit processing on a fairly large scale.

5] The MMDA will try to restore its image as an agency concerned with metropolitan development, in addition to doing the permit processing and will use GIS to help reshape its image.

6] The personnel who are the map makers within MMDA can be trained to digitize maps and will acquire the skill quickly

8.3.2 Sequence of Events

MMDA should start the GIS implementation to accomplish metropolitan area wide analyses which would complete Phase 1

Steps for Phase 1

1] Based on the surveys conducted for the preparation of the Second Master Plan, create a base map coverage of the scale 1": 1Mile which indicates different land uses as

specified by the development control rules of MMDA
2] Incorporate climate, topography, soil type which is geographic data available from the State Departments of Meteorology and Geology which are now on paper by digitizing them
3] Incorporate population distribution by block in the city and by town/village level outside the metropolitan area.
3] Incorporate Age -Sex Composition, Migration , Income, Literacy, Health and Employment statistics. This information is directly take from the census data which aggregates data by block.
4] Within the city area, urban utilities like water supply, sewerage and sanitation, electricity can be mapped, the information being transferred from paper maps already existing.
5] Location of Industries, places of education, trade and commerce related structures and location of public health facilities should be located as pin maps, that is within the city, one could know how many particular features were available o a revenue block.

8.4 Directions for Future Research

In this section, I will discuss some of the ideas that have occurred to me during the course of writing this thesis. I have not attempted to analyze the issues that I have raised except to the extent of presenting an interesting question that could be researched in the future. I raise these three issues because I think they are important to the future of GIS applications in developing countries: first, the impacts of GIS on the decentralizing of planning operations; second, the relevance of using GIS for rural management; and third, the extent to which computer technology is "culturally neutral" to the extent that it can be applied to different situations in both developed and developing countries.

8.5.1 Is Decentralization using GIS a Myth ?

Developing countries like India have inherited a very centralized system of decision making (a legacy of colonialism), and GIS has the potential to make this process even more centralized. In fact, the advocates for GIS in developing countries

are likely to see it as a tool which would foster rational-comprehensive decision making strategies. The technology could also be seen as a means to gain power and authority over other agencies. Thus, even though decentralization is possible using a GIS, it may not occur due to the constraints mentioned above.

The centralization of computer operations is likely to take effect in two ways, one internally and the other externally. First, it would have an impact on the internal structure of the organization, as the relative decision making power of the Division of Computerization is likely to be greater than the other divisions. It is possible that the highly centralized computer division would be responsible for shaping major policy decisions. For example, MMDA 's senior decision makers are bureaucrats who would be likely to make their final decisions on planning interventions based on what they perceive as rational choices. Other divisions who do not have a good grasp of the technology may have to yield to the computerization division's recommendations. This may result in the use of computers to promote concepts and ideas that are not suitable to the needs of the people of the Madras Metropolitan Area. These concepts may be difficult to challenge by those lacking equivalent information and analysis tools.

Second, the centralized operations of the agency have the capacity to move the decision making away from the community it is intended to serve. Again drawing on MMDA as an example, the Board has yet to become truly representative of the community it aspires to serve. Of the seventeen members on its Board, only one position, the Commissioner of the Madras Corporation represents local government and he too is a state appointed official (Sivaramakrishnan, 1986). The local professional communities or user communities do not form part of the decision process. Even if these groups do participate in discussions preceding a decision, the lack of understanding of the technology used by the agency may increasingly prevent them from being an effective challenge.

One research question could involve comparative study of similar metropolitan agencies, one which has not introduced the technology and the other which has, and to

see how their operations differ and how much of this difference, if any, could be attributed to the use of GIS.

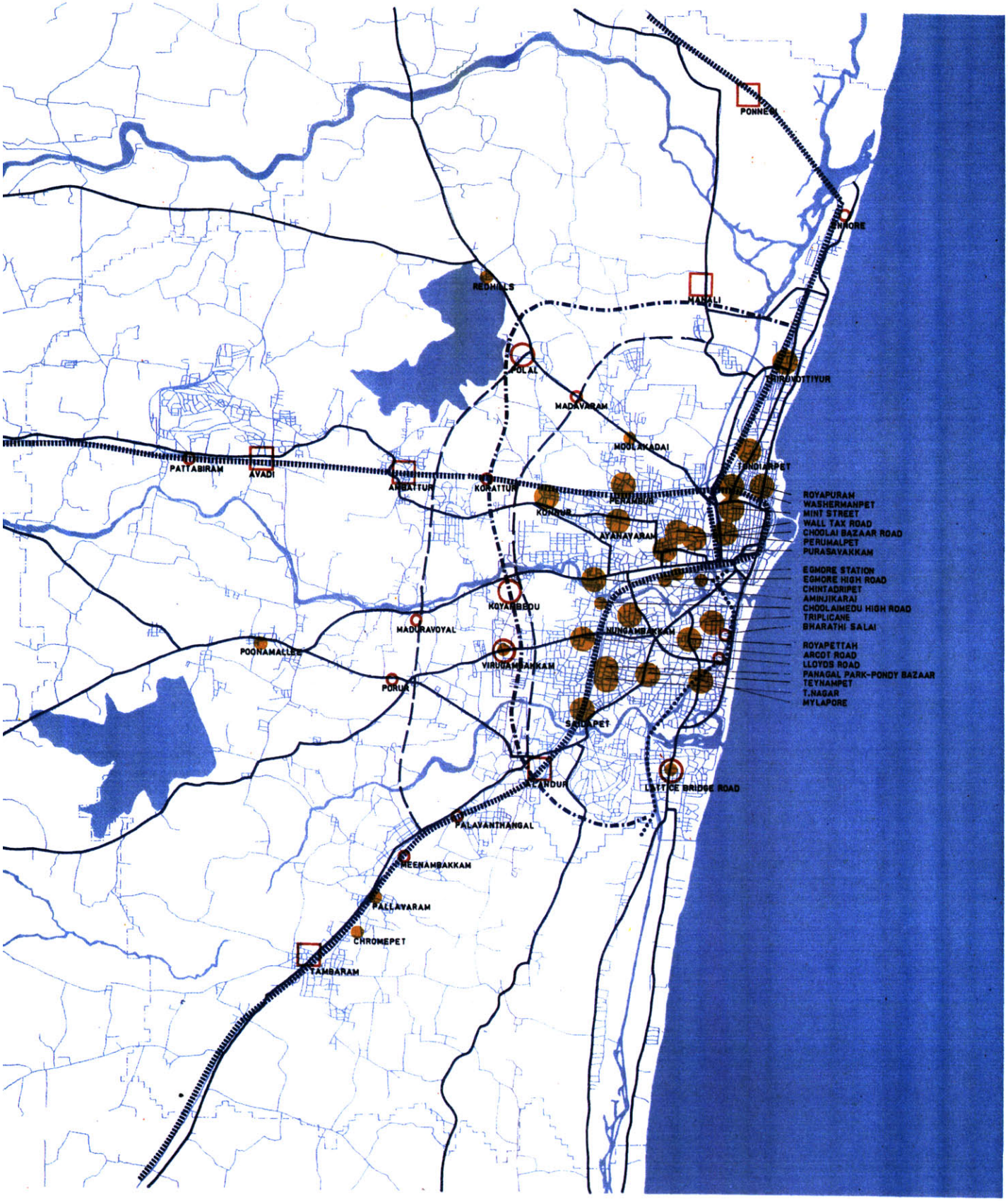
8.5.2 GIS for Rural Management

In Tamil Nadu, the line between rural and urban is very fine, because about thirty eight percent of the state has been classified as Urban (National Institute of Urban Affairs Report, 1988). It seems appropriate that GIS is used for rural development since administrators of small towns have less resources and personnel and have to deal with larger jurisdictional areas. There are technical problems in ensuring that a sustainable GIS can be placed in smaller towns, but further research would definitely have to address this issue.

Research in this area could analyze the requirements of local planning and management agencies at the municipal and village level and try to ascertain the needs that could be met through the use of a GIS and the constraints to its implementation.

8.5.3 Are computers culturally neutral?

The experiences embedded in computers are universal, that is they can be used in any situation. In this sense, at least, computers are 'culturally neutral' (Bowles, 1990). Change the word 'computers', substituting it with GIS implementation, and the statement would still be true. Constraints of data collection, updating, organizational and technical difficulties and scarce resources are similar in both contexts. However, there is very little comparative evaluation of GIS implementation efforts in the United States based on a defined framework for evaluation and analysis (Azad, 1990). Further research should design a framework for evaluation of GIS efforts world wide so that the statement about 'cultural neutrality' can be verified or refuted.



Proposed Rapid Transit System

Proposed Inner Circular Railway

Existing Major Roads

Proposed Major Roads

Existing Centres

Potential Centres

Urban Nodes as Identified in the Master Plan

Existing Railways

4KM²

1KM²

N

0 1 2 3 4 5 6

KILOMETRES

MADRAS.

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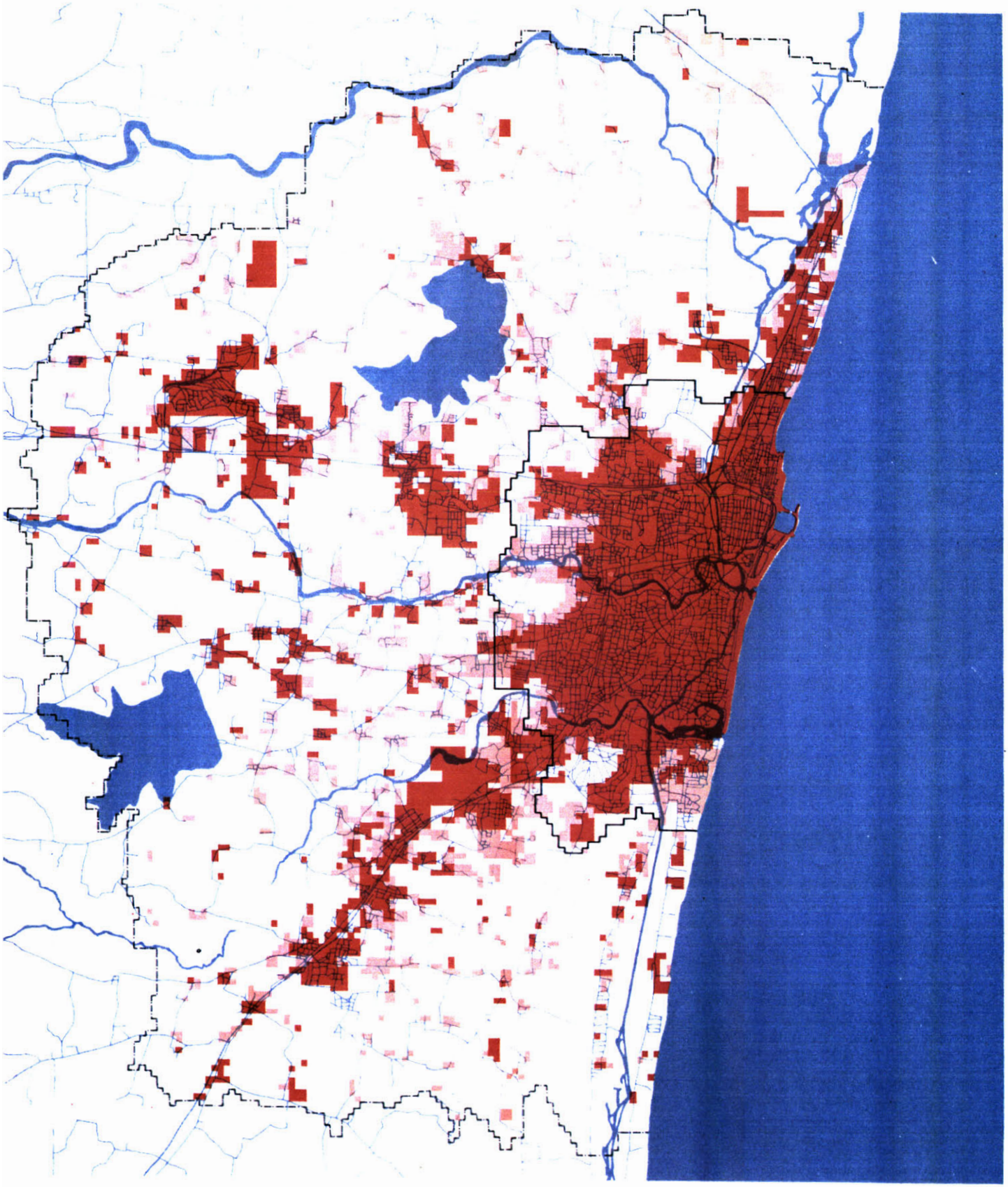
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

Based upon Survey of India maps with the permission of the Surveyor General of India.



MADRAS METROPOLITAN AREA - URBANIZATION

Intensively Developed Areas Over 75% in Urban Use

Sparsely Developed Areas 25%–75% in Urban Use

City Boundary

Metropolitan Area Boundary

4KM²

1KM²

N

0 1 2 3 4 5 6

KILOMETRES

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The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

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